SCIENTIFIC AMERICAN

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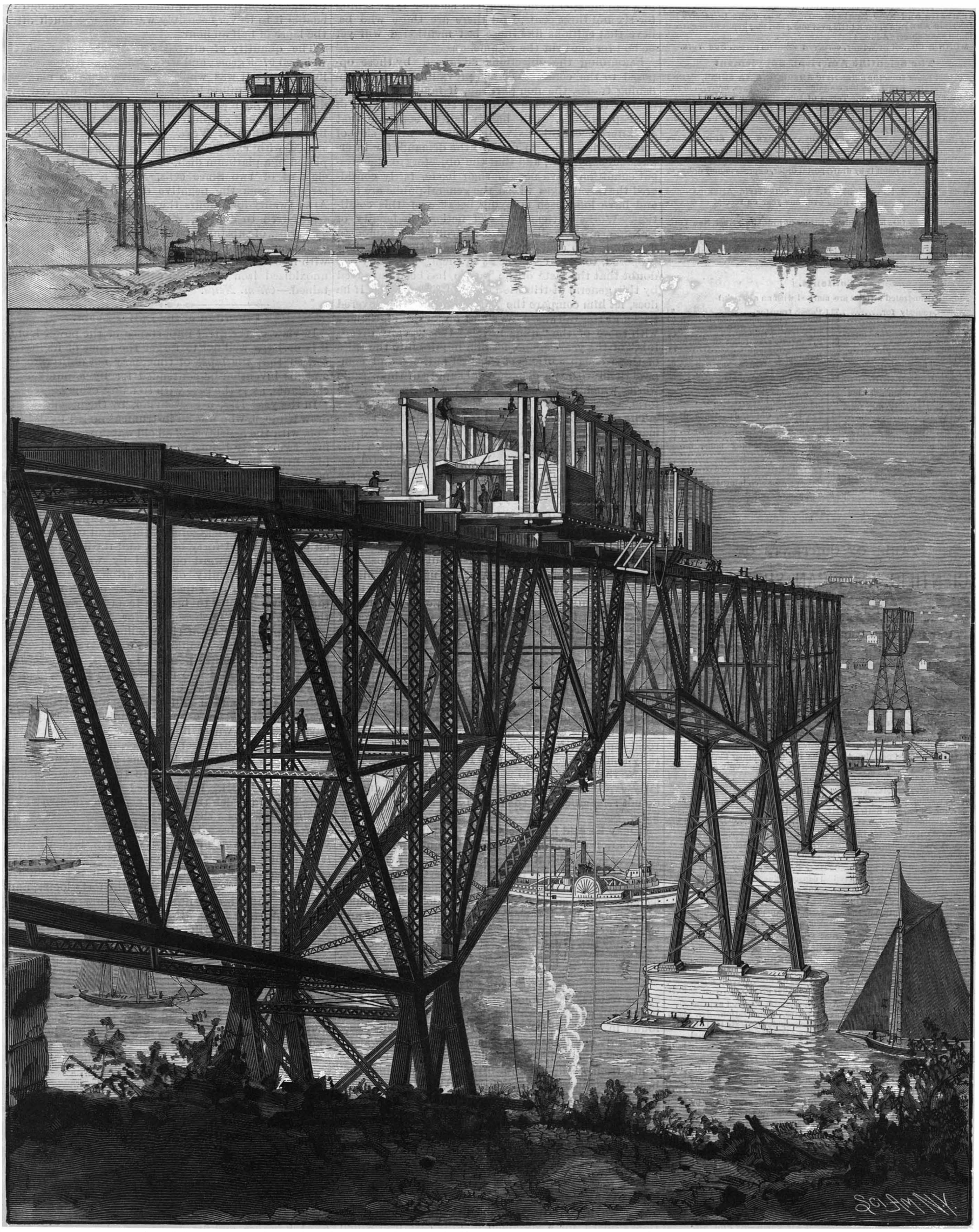

POUGHKEEPSIE BRIDGE OVER THE HUDSON RIVER—COMPLETING ONE OF THE MAIN SPANS.—[See page 70.]

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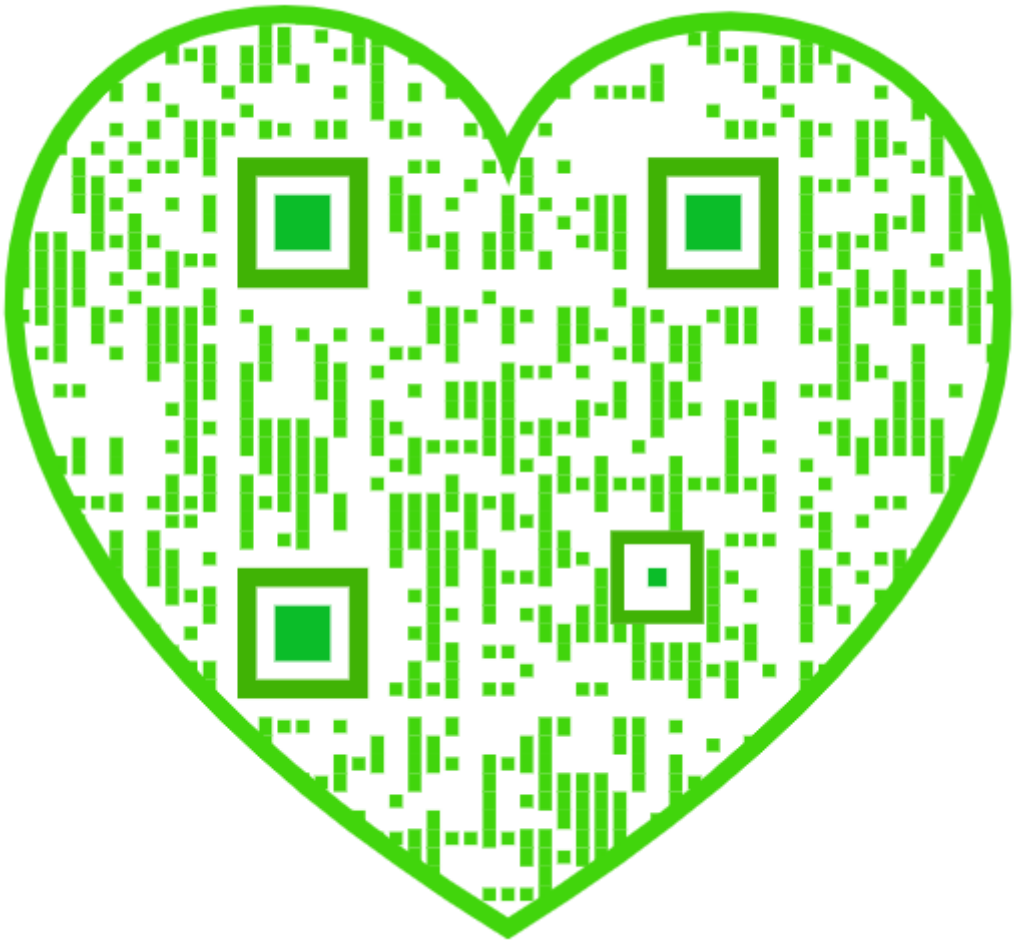

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THE BOOK PUBLISHING TRADES AND INTERNATIONAL COPYRIGHT.

A recent inquiry set afoot by this journal discovered that the sale of cheap books throughout the country is even larger than is generally supposed, and there is not any evidence, at least we could not find any, to sustain the assertion that the taste for these cheap reprints is on the wane. Competition in their production, it is true, is growing closer and closer, and consequently profit in making and vending them has been greatly reduced of late, and is likely to suffer a still further decline. Twenty-five cent editions, once regarded as remarkably cheap, are giving way to equally good editions retailing at fifteen and ten cents, and indeed the same books are now being published in a still cheaper form, though in smaller type, selling for six and three cents, and there are those who believe that editions like those last mentioned will yet be had for one cent the volume.

Examining the objections advanced by those opposed to the conditions now prevailing in the publishing trades, the non-partisan, if familiar with the change that has come through the introduction of "cheap editions," will hardly fail to conclude that self-interest on this as well as on the other side of the water has much to do with the demand for international copyright, and that the objectors to the present condition have not, in their haste, fairly considered the advantages which the general public are now and have long been enjoying because of this condition. Works of the masters of fiction, the faculty of learning, are now distributed at trifling cost among a multitude who could not hope, under the restrictions proposed, to have easy access to them. Does any one doubt that the taste of the public has been improved by this general distribution of good literature? If he does, let him compare the titles of the paper-covered books at the railway news stand and at his stationer's with those of the "dime novels," the "penny dreadfuls," of the years agone, let him inquire into the sales of these cheap editions of the best authors, and compare them with the demand and supply of these same works when they were published only in expensive form.

The supply of cheap literature has begotten the demand, and this has grown apace with what it fed on. What but this and the consequent taste which this has inculcated could have led to the wonderful development of the publishing trades which we see around us? Ought we to do anything to restrict this industry?

The moral point which has been thrust forward so prominently in this debate, and which some allege to be the most important point at issue, may not, because of this assumed importance, be left out in a consideration of the subject. To the average mind it will appear that if we demand no more of the foreigner than he accords to us we cannot be held, even by the severest moralist, to be his debtor or be fairly accused of withholding from him his due. An American book is scarcely any, if at all, more secure in England than an English one is here, for, though it is thought by some that, under British laws, prior publication in England will secure the work of an American author, the fact has by no means been established as yet, and there is a growing opinion that it will not be.

That there is a strong desire in England for a reciprocal copyright law there is no doubt, but are we morally bound to accede to it? If so, it would seem to follow that we ought to accede to the other and similarly expressed desire of reciprocity of trade, and we do not remember that the moralist has made an issue here.

It may be said in closing that the publishers themselves are far from united upon the question of international copyright, and that the solicitude evinced by many of them for the native author seems almost unnecessary upon a review of the evidence recently collected by us from the entire city trade as to authors' sales. Good literary work is in large demand, and those who can furnish it, so we learn, have more orders than they can fill at remunerative prices.

Action of Sea Water upon Cast Iron.

BY CARTER NAPIER DRAPER.

The results of the long continued immersion of cast iron in sea water are well known, and examples may be found in most of the books of reference. The most frequently cited instance is perhaps that related by Berzelius,* of cannon balls which were raised at Carlscrona from a ship sunk for fifty years, and which had become converted through one-third of their mass into "a porous graphitic substance, which became strongly heated when exposed to the air for a quarter of an hour." The chemical change which cast iron undergoes under these circumstances is usually stated to consist in the removal of the greater part of the iron, the residue consisting of graphite and a graphitic substance, FeC_3.

I have recently been indebted to the kindness of Mr. John P. Griffith, C.E., of the Dublin Port and Docks Board, for a specimen of gray cast iron which was broken from an old rail taken from a graving slip in the port of Dublin, and believed to have been laid in 1833. The rail was at about half tide level, and it may be therefore assumed that it was for twenty-five years immersed in sea water, and for a like period exposed to the action of the atmosphere. The fragment of iron weighed 557·31 grms., and measured 85 by 52 mm., with a depth of 20 mm. On its lateral surfaces it was slightly incrusted with sesquioxide. The upper surface for a depth of 7 mm. had been converted into a brown gray graphitoidal substance, which was without difficulty removed with a knife, leaving the surface of the iron bright and free from any adherent coating. During the operation of removing the easily pulverulent layer, the mass of iron became hot, not hot enough to cause inconvenience in handling, but hot enough to enable it to be very sensibly warm to the touch after the lapse of half an hour.

The quantity of altered cast iron thus removed weighed 67·59 grms., and was examined with the following results: It was wholly attracted by the magnet. Treated with dilute hydrochloric acid it evolved hydrogen, giving a pale green solution of ferrous chloride and a residue of graphite. The carbon was determined by the method of Weyl. The finely powdered substance, with excess of strong hydrochloric acid, was placed in a platinum dish, connected with the positive element of two Smee cells, while a platinum wire terminal from the negative dipped into the liquid. After twenty-four hours the contents of the dish were transferred to a filter, washed, dried, and weighed: 2·66 grms. of substance gave a carbon residue weighing 0·631 grm. = 23·6 per cent of carbon. By the reaction with free iodine abundant evidence of the presence of unoxidized iron (doubtless existing as FeC_3) was obtained.—*Chem. News.*

* Gmelin's Handbook, vol. ccxviii.

Invention of the Power Loom.

In view of the great importance of the power loom, it is perhaps well not to forget the name of its inventor, so that the lapse of time may not obliterate it, and his invention be contended for by a number of claimants, as is the case with so many others.

In the year 1793, a Scotchman, by the name of Andrew Kinloch, who was an instrument maker by profession, with the assistance of an old watchmaker built the first two power looms that were ever constructed in his little shop, in a monastery in Glasgow. The money necessary was furnished by two merchants of the city. The actuation of the looms was effected by a common crank, and after about fifty yards of good fabric had been woven on them, the experiment was considered to be successful. Kinloch at once received an order to build forty others, and the first forty-two looms were afterward operated by water power at Milton, in the vicinity of Dumbarton, Scotland. He was also appointed superintendent of the mill, and taught two pupils to become loom fixers. One of them, Walter M'Lutheon, was for many years afterward superintendent of the Wellington Mill, Hutcheston, near Glasgow, while the other, Archibald Barlay, received a similar position in the Coterine Mills, in Ayrshire. These two men were the first who used a screw wrench for regulating a power loom. The walls of the small old mill at Milton are still standing, overrun with ivy, as a hoary reminiscence of bygone days. The old wheel house still contains the water wheel of thirty-three feet diameter, used for actuating the looms. Two of the old looms had even been preserved, and were to be sent to the London world's exhibition of 1851. It happened, however, that the warehouse in which they were kept was destroyed by fire, and the looms shared the same fate.

After having been in operation for about twenty years, the mill was finally suspended in 1813, because it was not sufficiently remunerative. The beaming and sizing machine had not yet been invented. A firm at Paisley, Scotland, bought the forty looms, and operated them for a number of years with steam power. A short time after their purchase, however, the beaming and sizing machine was introduced in Glasgow, by which power loom weaving became remunerative, and within a few years after thousands of such looms were built and operated both in England and Scotland. In 1842, Walter M'Lutheon was still superintendent of the Wellington Mills in Glasgow, and also old Mr. Kinloch was still alive. He went once on a visit to Glasgow, and the bosses, fixers, and beamers of the already numerous mills in Glasgow celebrated the occasion by tendering him a sumptuous dinner. At the close a collection was taken up for the old man, which resulted in sixty pounds. He spoke of his early trials and mishaps, and said that, in Scotland, the weavers had offered no opposition to his invention. It had been otherwise in England, however, where the hand loom weavers had been of the opinion that they would be reduced to starvation by the introduction of the power loom. The first mill, at Staleybridge, England, which he had fitted up with one hundred looms, had been destroyed and burned during the night. It had been rebuilt shortly afterward, however, and fitted out on a larger scale than before. His life had been threatened repeatedly, for

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which reason he had lived for some time in America, where he had on all sides been received with open arms, and every facility had been offered him to introduce his loom in the different parts of the country. A few years afterward his looms had been introduced all over the continent of Europe.—*Industrial Record.*

Blow Holes.

The presence of blow holes in steel ingots has been accounted for by many ingenious hypotheses, and it would take several columns to relate all the theories that have been put forth to explain their formation. The latest exposition of the causes at work in producing this defect in steel castings comes from the pen of Mr. W. F. Durfee,* and has the merit of simplicity, while it offers an explanation which appears to fit the facts better than some. It will be remembered that in an ingot of mild steel the blow holes are not uniformly diffused through the mass, but are congregated in a band which, as seen in a cross section of the ingot, runs parallel with the sides, at a distance varying from ¾ in. to 2 in. from the edges. Now, whatever may be the nature and origin of the gases which have created the cavities, it is evident that a mechanical cause must be sought to account for their symmetrical arrangement in the mass of the metal. Mr. Durfee finds an analogy to the action which takes place in pouring an ingot in the blowing apparatus called the tromp, used in furnishing the blast for the forges of Catalonia. In this instrument a vertical pipe several feet in height connects two vessels. The upper vessel is kept filled with water, while the lower, which is closed, is connected by a tube with the tuyere of the furnace. At a short distance from the top of the vertical pipe there are a number of air inlets, while the mouth of the pipe is closed by a valve. When this valve is raised the water rushes down, and by its descent it draws in air through the holes provided for it. The air and water descend together into the lower box, which acts as a separator; the air at a moderate pressure rushes through a tuyere into the fire, while the water escapes through an opening which is always kept sealed. A modified form of this device is sold to supply air to the blowpipes of glass workers. This phenomenon of the enlargement of air by a descending column of water may be demonstrated by aid of a tumbler held under an ordinary water tap. When the tumbler is filled, a stream of bubbles will be seen to descend the center of the vessel along with the incoming water, and then to divide and flow up the sides. A part of the air is caught again in the eddy just before it reaches the surface of the liquid, and is again carried down, so that there are always a large number of bubbles in the water arranged in a central column and a peripheral belt. The fluidity of water is so perfect that immediately the stream is stopped the bubbles all escape, but if a quantity of mucilage or gelatine be added to the fluid to render it viscous, then the air is detained, and it is possible to study the arrangement of the bubbles at leisure. By pouring melted gelatine into an ingot-shaped mould, and then cooling it very rapidly, a honey-combed mass may be obtained bearing a very close analogy to an ingot of steel.

It must be confessed that the pouring of an ingot is quite as capable of giving rise to air bubbles as is the running of a stream of melted gelatine. The molten steel falls through the air, and is somewhat viscous, while it rapidly begins to solidify when it meets the surface of the mould. There is, however, a striking difference between the air bubbles in steel and those in gelatine, the former being greatly the larger. This can be accounted for by the great expansion of the air caused by the heat, and by the dissociation of the water carried in the very moist air of the casting pit. Taking the temperature of the molten metal at 3,300 deg. Fahr., the air would suffer a sevenfold expansion, while the volume of the water would be increased from two to three thousand times when converted into gases at ordinary temperature and pressure. Hence a very small bubble of air may well be conceived to produce a blow hole of large size, even when compressed under a head of several feet of fluid metal, although the oxygen probably combines immediately with the steel to produce the iridescent lining usually found in the cavities, leaving behind it little besides hydrogen and nitrogen.

The examples used to explain the presence of blow holes in steel suggest the means of getting rid of the cause of them. The air bubbles rise out of a glass of water the moment the stream stops, while in the case of mucilage the rate of clearing is inversely as the viscosity. Now, if the fluidity of steel be largely increased, it is a fair inference that there would be a proportionate decrease in the number of blow holes to be found in an ingot. This extra and hitherto abnormal fluidity can be obtained by adding to the metal in its molten state one-twentieth to one-tenth of aluminum, which at once brings the steel to a condition in which it will run like water, and enter the tiniest crevices of a mould. The reason of this effect is not known, but it is not at variance with characteristics of many alloys which are known to have far lower melting points than any of their constituents. Already aluminum is largely used in the production of iron castings made from melted scrap, and the experience gained with it shows that while it renders iron perfectly fluid at a temperature at which it would otherwise be scarcely more than pasty, it improves the quality, and confers upon the metal an increased tenacity twenty per cent greater than that of the iron from which it has been made.

It is to aluminum that Mr. Durfee looks for the more or less complete abolition of blow holes in ingots. He believes that it is only necessary to render the steel sufficiently fluid for the air globules to be able to disentangle themselves, to do away with this great defect, which in spite of all rolling and forging detracts from the strength of objects made from this metal. No doubt an increased fluidity would improve all classes of steel castings, but if it is the air which is carried down by the falling metal which constitutes the cause of blow holes, surely a mechanical remedy could have been found for it. Moulds can be filled without letting the steel drop through the air like water from a tap, and a very easily tried experiment would show whether Mr. Durfee's hypothesis is correct or not. Whether it be or not, there appears to be great hope in the use of aluminum.—*Engineering.*

* Proceedings of the United States Naval Institute.

PHOTOGRAPHIC NOTES.

Film Negatives.—During the past year, improvements in the production of negatives on thin transparent gelatine and collodion films have been effected, which will eventually do away with the use of glass as a support, and thereby considerably lighten the labor of the amateur. Speaking of these prepared sensitized films, Mr. Pumphrey, in the *Br. Jour. of Photo.*, says:

The sensitive medium is supported on a paper back, but is separated from it by a special non-actinic medium, which secures three points. It prevents the light from the camera passing from one film to the next; it prevents any grain being communicated from the paper; and it holds the film during the stages of exposure, development, fixing, drying, and varnishing, and when the whole is completed and dry the film is *lifted quite clear and clean from the bed* which has carried it.

The film is quite strong enough in the smaller sizes to be used in any dark slide which has a rabbet all round, if a piece of thick card is placed behind it. For sizes larger than 6½ × 4¾ inches a slide with one glass and a back to press against the glass is recommended.

The films are as flat and manageable as plates. They only require to be placed in a dish and the developer poured over. No wetting to start with. Any developer will answer with the film, but I recommend the following:

A.

Warm water	2	ounces.
Sulphite of soda	2	"

When cold, add:

Sulphurous acid	2	ounces.
Pyrogallic acid	½	ounce.

B.

Carbonate of potash	3	ounces.
Sulphite of soda	2	"
Water	7	"
Solution C (bromide of potassium)	1½	drachms.

C.

Bromide of potassium	1	ounce.
Water	2	ounces.

To develop, mix equal parts of A and B, and to every half ounce of mixed solution add from half an ounce to six ounces of water, according to the taste of the operator. The more water, the slower the development and the weaker the negative. The stronger the developer, the stronger the negative.

The proportion of bromide of potassium may be increased if a stronger picture is aimed at, or reduced when softer results are desired. The film when wet is sufficiently transparent to allow of accurate attention being paid to the density if it is held close to the lamp.

Fix in clean hyposulphite of soda, placing the negative face downward, as if the film rises above the surface it may be discolored. Be careful to fully remove the bromide, as it is not quite as easy to determine as with plates; leave long enough. Pass into a saturated solution of alum to harden, and clear, for not less than five nor more than ten minutes. If left much longer than ten minutes the film becomes brittle, but on no account omit the use of the alum. Wash after the alum for not less than four or five hours, as less time will not make a permanent negative.

To Dry.—Take the film and remove the water by draining, or with a cloth or paper, place it face downward and paste the back of the film, put the pasted film on a stout card or millboard at least an inch larger each way than the film. One other precaution is needed, that is, to prevent the edges turning up as it dries. This is secured by pasting a narrow strip of paper over about three-sixteenths of the edge of the film, and the rest on the card. Allow the film to dry, but not in a hot room. The moisture will pass through the card at the back as well as from the surface of the film. It will take ten to twenty hours. The feel of the surface will be a guide to when it is quite dry. A suitable paste is made by mixing one ounce of flour with six ounces of cold water, till all lumps are broken up, and then boiling.

Varnishing.—This should not be omitted, as it gives stability to the film and prevents injury in printing. Take the card and film and warm at a fire to a temperature of about 100°; apply the varnish with a brush and again warm at the fire. The film may now be lifted, but first pass a knife all round between the film and the supporting medium. It will then lift with the greatest ease. The cards can be used many times over if the medium be removed by rubbing. The drying of the film causes the card to twist by its slight construction. In pasting a fresh film on the card always put it on the convex side.

Sensation of Warmth Produced by Carbonic Acid Gas.

At a recent meeting of the Physiological Society, Berlin, Dr. Goldschneider spoke on the fact, which has been known for a long time, that when carbonic acid gas is allowed to come in contact with the skin, it produces a greater sensation of warmth than air of the same temperature. He has carried out a prolonged series of experiments to determine the cause of this increased sensation of heat. He examined first the purely physical factors which might have some influence on the observed facts—namely, the moistness, specific heat, and heat absorption by the gases. When he compared the sensation of heat produced by moist air with that produced by dry air, he found that the former always seemed the greater. The difference between the two might be as much as 5° C. to 6° C. when the air was at a higher temperature than that of the skin. Thus, air at 35° C. whose saturation with moisture was 80 produced the same sensation of heat as air at 41° C. whose saturation was only 30. When experimenting with carbonic acid gas, he found that a difference of 40 in the saturation produced a difference in the resulting sensation of heat corresponding to 2° to 3° of temperature. But even when equally moist or dry air and carbonic acid gas were allowed to act on the skin, the sensation of heat produced by the latter was always the greater. It does not seem possible to explain the greater sensation of heat with carbonic acid gas by reference to the extremely small differences of specific heat of air and this gas, still less by reference to their somewhat greater coefficients of heat absorption. He also investigated the effect of the more ready absorption of carbonic acid gas by fluids, by removing the epidermis with a blister on a circumscribed portion of the skin and allowing the gas to act upon this place. The carbonic acid gas was speedily absorbed by the lymph, but it still produced a sensation of greater heat even when all moisture was removed from the surface exposed by the blister. He hence considers that the purely physical properties of the gas will not suffice to explain its remarkable influence on the sensory nerves for heat. Dr. Goldschneider next investigated the physiological factors which might suffice to explain the observed phenomenon. He proved that there is no recognizable objective rise of temperature under the influence of the carbonic acid gas. It is true that he observed now and again a distinct dilatation of the blood vessels, but this was by no means constant, and not sufficient to account for the increased sensation of heat. He proved, however, as has been observed by many physiologists, that the carbonic acid gas has a direct effect upon the sensory nerves; but in contrast to the results of others, who attribute an anæsthetic action to this gas, he observed that at first it produces a hyperæsthesia of those nerves specially connected with the production of heat sensations, and then this makes way for an anæsthesia. The nerves connected with heat sensations were more strongly stimulated than those connected with sensations of cold. The speaker summed up the results of his extremely numerous experiments by urging that in addition to the greater absorption of heat by the carbonic acid gas and its power of producing hyperæmia of the skin, its action is to be explained chiefly by its direct chemical action on the endings of the nerves concerned in the production of sensations of heat. This, therefore, is to be regarded as the cause of the observed phenomenon, that when carbonic acid gas is brought into contact with the skin, it produces a greater sensation of heat than does the contact of equally warm and equally dry air.

THE *Age of Steel* cautions its readers against filling a box with Babbitt metal without first washing the box with alcohol and dusting over the surface with sal ammoniac. Wherever a tinned surface is formed, cover the remaining surface of the box with clay wash to protect it against the attack of the fused metal. To solder a joint that is to be carefully united, the surfaces must be nicely fitted with a file and then cleaned thoroughly before bringing the parts together. A piece of tin foil will occupy a small space, and cover the whole surface, and when the work is heated slowly in a fire, the parts can be united so nicely that the joint will be almost invisible.

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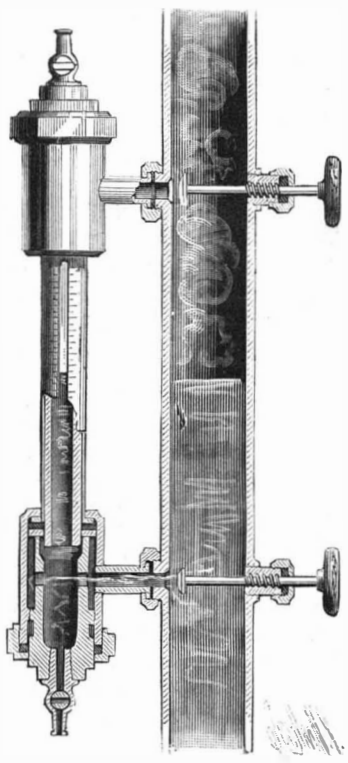
WATER GAUGE AND WATER COLUMN COMBINED.

An improved water gauge and water column combined, illustrated herewith, has been patented by M. Parker and J. E. Tupper, of Rothsay, Minn. The glass is placed in a metal tube having graduated sight slots, and collars screwed to the ends, against which the packing for the glass is placed. The head pieces are tubular, having inwardly projecting flanges, against the inner surfaces of which the collars of the tube rest.

A compression sleeve is screwed into the head piece, its inner end resting on a metal washer placed over the packing of the glass, which is thus pressed against the collar and it in turn against the flange, forming a rigid connection between the head pieces, without any possible strain on the glass. The packing being within the head piece, any pressure of water or steam only tends to force it more firmly against its seat and prevent leakage. The compression sleeve has suitable perforations to allow the free circulation of water, and is provided at its outer end with a hexagonal head to which a wrench may be applied to vary its pressure on packing, and a cock for the removal of sediment. A packing cap is screwed to the outer end of the head-piece to prevent leakage around the sleeve.

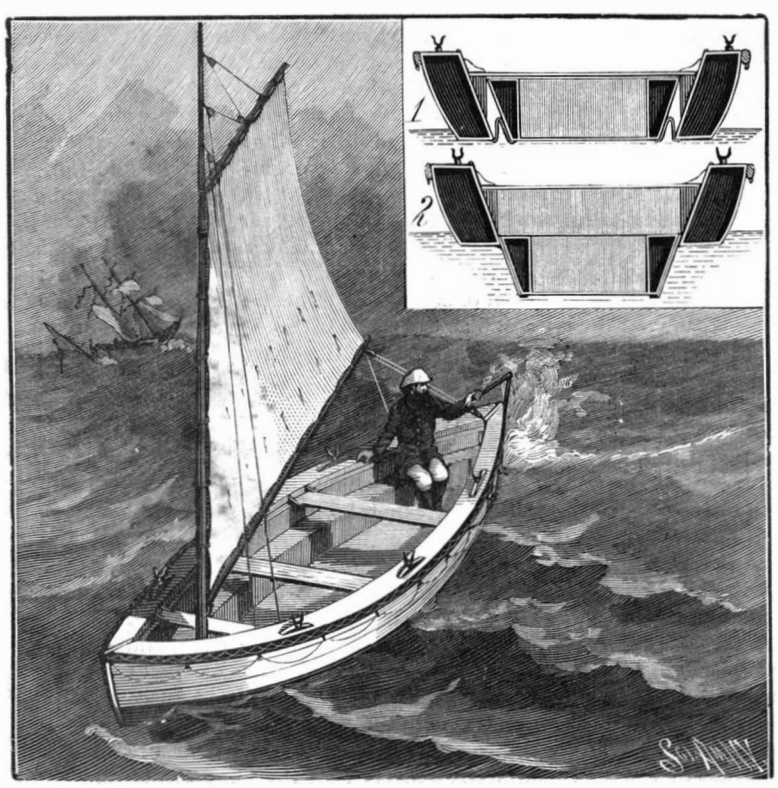


PARKER & TUPPER'S WATER GAUGE AND WATER COLUMN COMBINED.

The head pieces are connected to the water column by suitable nipples and union joints, to facilitate removal for repair. The valves which close the passages are within the body of the water column, with their handles on the side opposite the glass, so that in case the glass breaks they may be closed without danger to the operator. The whole is so designed as to be cheaply constructed, of artistic proportions, and easily polished and kept clean, while furnishing the greatest degree of safety and facility with which it can be operated, the glass and its connections being easily removed for cleaning or repair while the boiler is under pressure.

AN IMPROVED LIFE BOAT.

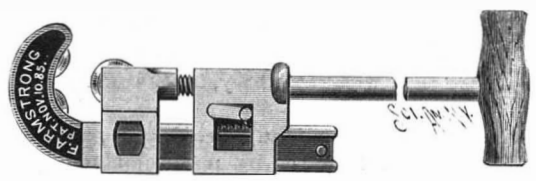
The life boat shown in the accompanying illustration is made up of upper and lower sections, forming, as it were, a boat within a boat, after a novel form of construction, devised by Mr. William Lockerly, of West Newton, Mass. The upper section has a large outside air space, its walls forming the body of the boat, while the lower section, also completely surrounded by an air space, has a flat bottom, and is pressed up into the upper section when afloat, unloaded, as shown in the sectional view, Fig. 1. The flat bottom of the lower section is securely fastened to the lower part of the upper section, or outside air space, with strong three-ply waterproof canvas, forming one completely water-tight boat, as shown in section, when loaded, in Fig. 2. The air spaces in the boat are divided into water-tight compartments of two feet in length each, and are of such size as to be equal to the full carrying capacity of the boat, which would not, consequently, be sunk if entirely filled with water. The pressing of the lower section down into the water as the boat is loaded acts to ballast it, while the disposition of the air space is such that it is almost impossible for the boat to be upset. A canvas fender prevents the lower or inside section from oscillating against the outside air space in a broadside sea, and a canvas fender, filled with cork shavings, runs along the rail where the life lines are attached. A boat of this class, such as represented, 20 feet long, 6 feet beam, and 2 feet 9 inches deep, will weigh about 1,100 pounds.



LOCKERLY'S SELF-ADJUSTING LIFE BOAT.

A SIMPLE AND EFFICIENT PIPE CUTTER.

A rapid working tool for cutting pipes, which can be quickly and easily adjusted for cutting pipes of different sizes, is shown in the accompanying illustration. It is adjusted from a large to a small size by pushing the hooked bar through the yoke until the wheels meet upon the pipe, after which the cutting is done by passing the device around the pipe, the cutting wheels being kept up to their work by turning the handle as required. To change from a small to a large sized pipe, the ratchet or pawl by which the hooked bar is held in position on the handle bar is lifted, and the hooked bar pushed out to accommodate the desired size. This device is manufactured by the Armstrong Manufacturing Company, of Bridgeport, Conn., in two sizes, No. 1, for cutting ⅛ inch to 1¼ inch pipe, and No. 2, for ½ inch to 2½ inch pipe.



A THREE-WHEELED PIPE CUTTER.

Martineau's New Remedy for Diabetes.

Martineau's new anti-diabetic remedy, which is now being called for by physicians and druggists, is an artificial lithiated arsenical water. Martineau claims extraordinary results from this water, recording 67 cures out of 70 cases, *i. e.*, 96 per cent. The mode of preparing and of prescribing this remedy is as follows: A siphon bottle holding about a liter (one quart) is taken; into this is put a powder consisting of 20 centigrammes, or about three grains, of carbonate of lithia. A tablespoonful is then added of the following solution:

Take of distilled water 500 grammes (1 pint 5 drachms).

Arseniate of soda 20 centigrammes (about 3 grains).

M. Dissolve.

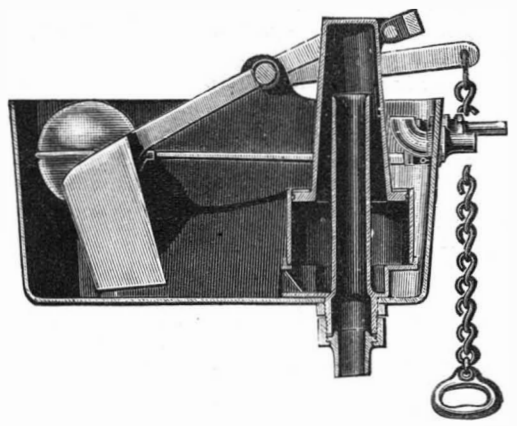
The siphon bottle is then charged with carbonic acid water from a soda fountain, and is ready for use. The patient makes this water his principal beverage, taking the whole quantity in about equally divided doses with his meals. The bottle must be freshly charged every morning. Martineau allows the patient to take with the water a little wine. The diet is not modified, except that a certain amount of reserve is enjoined in the use of starchy foods, fruits, and sugar.

Martineau claims to have learned this mode of treatment from Professor Rouget twelve years ago. When the diabetes is treated by lithia alone, or by arsenic alone, the result is not the same. Many of the natural mineral waters, as Vichy, Royat, Bourbole, Pourges, St. Nectaire, and even Canterets, have a favorable action on diabetes; this is due, Martineau thinks, to the fact that they all contain lithia, and some of them, notably Vichy and Bourbole, contain arsenic.

Any physician in country practice where easy access can be had to a soda water generator can prepare for his diabetic patient Martineau's remedy. He has only to fill an ordinary quart bottle, in which he shall have previously put a three-grain carbonate of lithia powder and a tablespoonful of the above-mentioned solution, with gaseous water from the soda fountain, and order the whole quantity to be taken during the day after meals. As for the curative value of this prescription, there is justification for considerable skepticism. Dujardin-Beaumetz, at the meeting of the Societe de Therapeutique where Martineau's paper was read, expressed grave doubt as to whether the 67 cases cited by Martineau were typical cases of diabetes, and was tempted to believe that Martineau had fallen upon a series of cases of *alimentary diabetes*, like those treated by Cantani at Naples, where abuse of pastry, sweets, and starches had given rise to a temporary glycosuria that was not true diabetes.—*Med. and Surg. Reporter.*

AN IMPROVED WATER CLOSET BOX.

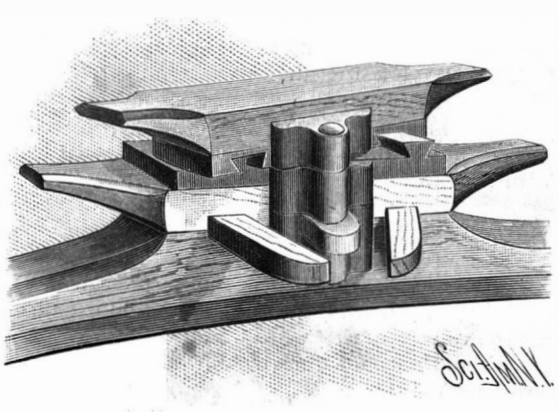
A siphon service water closet box in which there are no valve faces to wear and cause leakage has been patented by Mr. William Davies, and is shown in the accompanying illustration. From the arrangement of the moving cap, or piston, in the cylinder, with the reflex diaphragm in the passage between the cylinder and the cistern, it is impossible for the box to be emptied unless by the charging of the siphon by pressing down the piston, there being no direct outlet from the cistern except that down the flushing pipe, the top of which is above the top of the cistern, and waste cannot occur except by a defective ball cock, which at once shows itself by the overflow or warning pipe. The siphon being once charged, this service box is very easily worked. For further information relative to this invention, address Mr. Jos. E. Hannah, Winnipeg, Manitoba, Canada.



DAVIES' VALVELESS BOX FOR WATER CLOSETS.

IMPROVED RUNNING GEAR FOR VEHICLES.

A novel construction of front running gear for vehicles, designed for both heavy and light work, is shown in the accompanying illustration, and has been patented by Messrs. Henry Warmington and Benjamin Bulger, of Virginia City, Montana Ter. The forward axle has fixed to it the sand board, over which the head block is arranged, metal plates being fixed to the opposing faces of the sand board and head block. In one of these plates, preferably the lower or sand board plate, a projecting dovetailed tongue is formed, on a curve struck from the center of the king bolt, and the opposing or bolster plate has a corresponding dovetailed recess, into which the tongue fits snugly, but so as to allow the head block with its plate to turn freely either way as the vehicle is turned to one side or the other. The king bolt passes through lugs fixed to the axle, the sand board, and head block, as well as the reach, so that the tongues and grooves and king bolt mutually re-enforce each other, whether the vehicle be running straight or while being turned; and should the king bolt break, the tongues and grooves will prevent disconnection of the head block and sand board. For spring wagons, this construction obviates the necessity for a fifth wheel extending back of the head block and axle.



WARMINGTON & BULGER'S RUNNING GEAR FOR VEHICLES.

Among the almost numberless methods of removing particles from the eye, the following is recommended as an efficient means: Make a loop by doubling a horsehair. Raise the lid of the eye in which is the foreign particle; slip the loop over it, and placing the lid in contact with the eyeball, withdraw the loop, and the particle will be drawn out with it.

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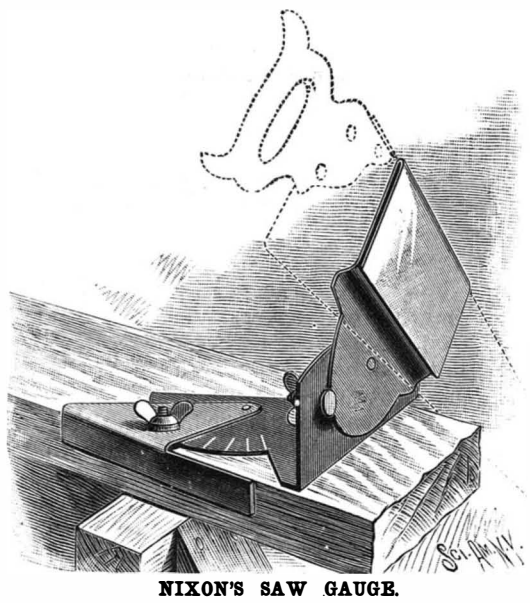
AN IMPROVED SAW GAUGE.

A saw gauge which can be readily applied to a block or board, and held firmly in place thereon to accurately guide the saw in the desired direction, is illustrated herewith, and has been patented by Mr. Edward S. Nixon, of Chattanooga, Tenn. In a flanged base plate, adapted to rest against the side or edge of any article



NIXON'S SAW GAUGE.

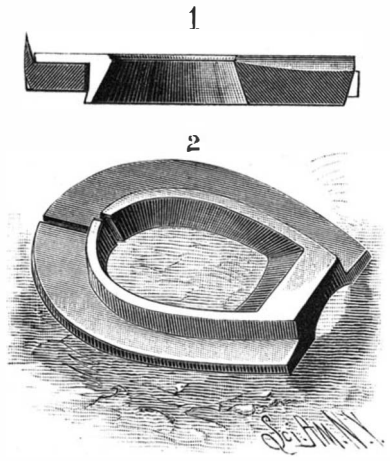
to be sawed, is mounted a set screw, against which rides the semicircular edge of a scale-marked and pivoted guide-holding plate, which can be fixed at any angle by the set screw. To the upright portion of the guide-holding plate is pivoted a saw guide, also held by a set screw at the desired inclination, and so that it can be lowered as the cut progresses, while the saw will be continually embraced by the parallel sides of the guide, and thus saw accurately in a plane at right angles to the edges of the board or block. In making light gauges it would not be necessary to make the tilting joint for the upright part of the guide, which could be made integral with the other portion of the guide. The saw used is a common hand or panel saw, and the device is well adapted for cutting miters and octagon or other shapes. The metal of which this gauge is made is light, and the construction so simple that it can be readily constructed by any good tinner.

Color Blindness a Brain Affection.

Professor Ramsay believes that the particular defect giving rise to color blindness lies, not in the eye itself, but in the brain. Certain persons, he points out, are incapable of judging which of two musical tones is the higher, even when they are more than an octave apart. Yet, as such persons hear either tone perfectly, the defect is not one of deafness. He accordingly argues that in such persons the brain is at fault, and thence proceeds to the assumption that it may be equally true that the inability to perceive certain colors is not due to a defect in the instrument of sight by the eye, but to the power of interpreting the impressions conveyed to the brain by the optic nerve. If this is the case, the problem is no longer a physical one. It falls among those with which the mental physiologist has to deal.—*The Medical Press.*

AN IMPROVED HORSESHOE PAD.

Making the pad of a horseshoe with a beveled flange projecting down inside the shoe to prevent balling, and with a division or joint at its front end, whereby the pad may be expanded to suit the size of the hoof, is a patented invention of Mr. William A. Taylor, of Washington, D. C., and is illustrated herewith, Fig. 1 showing a horizontal section from front to rear of the shoe. The pad is moulded of soft rubber, the exterior of the shoe fitting around the downwardly projecting flange, which extends about a quarter of an inch below the shoe. The flange serves to hold the pad in place while the shoe is being nailed through the body of the pad, and by pressing against the ground tends to prevent slipping. The rear portion of the pad is made continuous, affording a solid bearing surface, while the flaring central opening allows snow to be easily knocked out, thus preventing balling, and the division in the middle at the front allows the pad to be easily expanded to the required dimensions.



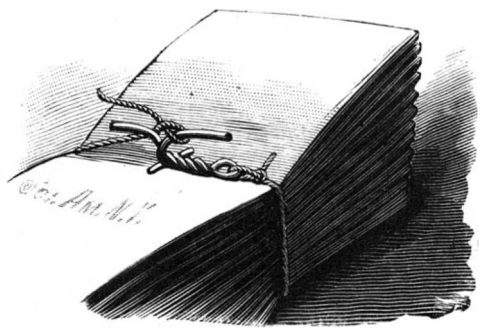
TAYLOR'S HORSESHOE PAD.

Cheap Stationery.

It is a mistake to suppose that cheap stationery is a matter of economy, says the Appleton, Wis., *Post.* It should be borne in mind by every business man that his letter paper is his representative to many people who have never seen him, and who are likely to form their judgment of him, to a large extent, by the qualities of his proxy. A man who uses poverty-stricken stationery stands in a bad light to those he addresses himself to. For the sake of economizing a few cents he gratuitously prejudices himself in the opinion of many people who may be of importance to him; for good stationery is like a good suit of clothes, and so long as men continue to judge from appearances, they will find both of value to them.

AN IMPROVED CLEAT.

A device designed to afford a quick and secure tie, using one end of an attached string or tape only, is shown in the accompanying illustration, and has been patented by Mr. Charles P. Hawley, of No. 510 West 153d Street, New York City. It is preferably made of one piece of wire, bent to form a loop or eye, to which the tape or string is fastened, and then bent up and twisted to form a shank, with outwardly extending diverging arms integral with the shank, a guide

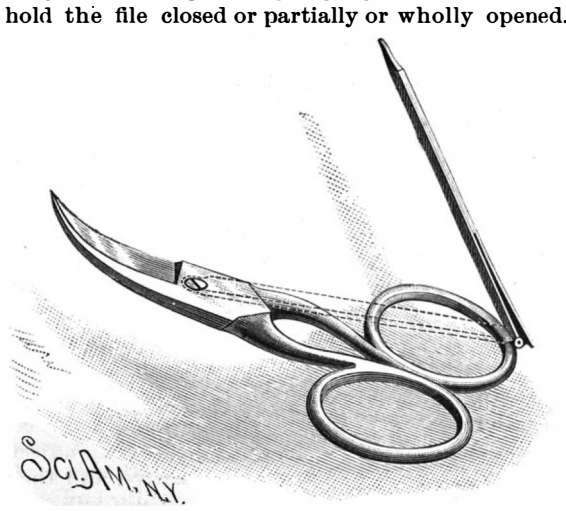


HAWLEY'S PORTABLE CLEAT.

bar being attached across the body at the bottom near the neck. The cleat may also be made of any size, and of one, two, or more pieces.

A COMBINATION TOILET IMPLEMENT.

A combination of a pair of scissors and nail file, wherein each is perfect in itself, making an article which can be conveniently carried in the vest pocket, is illustrated herewith, and has been patented by Mr. Charles P. Hawley, of No. 510 West 153d Street, New York City. A right-angular lug is provided on the rear of the eye of the scissors adapted to receive the thumb, forming a shoulder to which the file is hinged. The file is split horizontally to about its center, to form two portions, one portion being bent upon itself to form an eye by which the file is hinged to the shoulder, and the other portion acting as a spring against the shoulder to hold the file closed or partially or wholly opened.



HAWLEY'S COMBINED SCISSORS AND FILE.

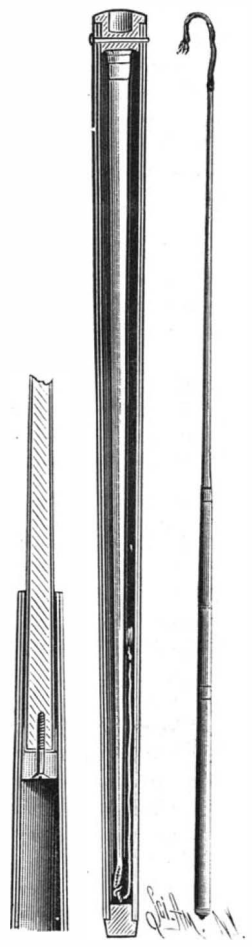
Both implements being commonly employed in dressing the nails, they are, when thus combined, at once in immediate hand for use.

THE *Railroad Gazette*, referring to the numerous patents on car couplers, and the difficulty experienced by the railroad officials in determining the lines of the future standard Janney type coupler, quotes the sayings of a facetious master mechanic. He suggests that car coupler inventors should turn their attention to an automatic locomotive engineer—one who would never look on the cup when it is red, never lose time, never have leaky flues or a hot box, and never misread orders, have a collision, or stick in a snow bank. He says he feels sure such an invention would attract the attention of our great railroad monopolists and fulfill a long felt want, especially if it could be warranted to run 200 miles after a nickel had been inserted in the slot.

"CHEESERINE" is the latest fraud in England. It has a suggestion of cheese, as American oleomargarine suggests butter.

A COMBINED WHIP AND CANE.

A construction designed to give greater strength, simplicity, and convenience than is usually obtained in a combined whip and cane is illustrated herewith, and has been patented by Mr. Owen Godward, of Salem, Ohio. The handle is a tapering, tubular body, preferably of iron, covered by suitable wrapping, such as ordinarily used on whip stocks. When used as a cane, the handle completely incloses a tapering whip section, of whalebone or other flexible material, covered with a suitable wrapping, the whip section being adapted to be drawn outward until its inner larger end binds snugly in the smaller open end of the handle, the whip section being held firmly in place by a screw passing through a frictional block which adheres closely to the metallic tubular body. The larger end of the handle is closed by a detachable plug, the outer end of which has a socket to receive the neck of a rubber or other suitable block when the article is used as a whip, the neck of the block also fitting the smaller open end of the handle to serve as a ferrule when the article is used as a cane.



GODWARD'S WHIP AND CANE.

Leather Board for Shoes.

The use of leather board in shoe manufacture is one of the shoddy features of the business. One kind is used for tapping and for veneering taps. The material is made to look like leather and to cut like leather. A thin split of true leather makes a veneer that satisfies the demands of the buffing machine.

The best board is made of such board stock as jute, manila, and the like, and this is used for counters, or boot and shoe heel stiffenings and for box toes. When properly treated and manufactured, these counters do good service. When leather board is backed with a leather split and moulded into a stiffening, the product is a union counter. Even chair seats are made from this board. It is worth five to twelve cents a pound.

A cheap leather board, worth three cents a pound, is used for inner soles, shanking, filling, and so on. Steel shanks are also covered with this, and inner soles, backed with cotton duck, are made of it. This is used, not to cheapen the cost of making the shoe, it is said, but to save the time of gathering and arranging leather scraps.—*Paper World.*

IMPROVED TONGS FOR HANDLING NAILS.

A hand implement or tool for handling nails in quantity is shown in the accompanying illustration, and has been patented by Mr. Andrew Wood, of Washington, Ky. The crossing levers or handle portions of the tongs are extended to form jaws composed of a number of internally notched or serrated tines, the levers being pivoted to each other in close proximity to the bent tine portions. By this means an easy lift and secure hold of the nails in large quantity is obtained, the leverage being proportional to the length of the handles, on which both hands may be used, while the notched or toothed construction of the tines prevents the slipping or dropping of the nails.

WOOD'S NAIL TONGS.

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The Fathers of the Steam Navy.

The claim of Mr. Wm. Elliott Griffes, in the biography of the late Matthew C. Perry, that the commodore was "the father of the steam navy," has excited some comment among the older officers of the navy, and among old engineers in general. The biographer, perhaps with the best intentions, imparts the idea that Commodore Perry really designed the machinery of the Missouri and the Mississippi—a claim as unjust as it is unwarranted. These were the first great steamers the country ever had, but their success in management does not belong to Perry. They were sister ships. The former had inclined engines, according to the patent of the principal engineer of the navy (Mr. C. W. Copeland), and the latter had side lever engines. Both engines were designed by Mr. Copeland.

Robert Fulton, in 1814, built for the navy the first war steamer ever owned by any government. She was called the Demologos, but was afterward called Fulton the First. Fulton was appointed engineer, by the Navy Department, for this purpose, and was therefore the first person who ever held that title in the navy. She was originally intended to throw hot water as well as shot. She blew up while receiving ship at Brooklyn, in 1829, killing Lieutenant Breckenridge and 47 others, and wounding as many more.

Lieutenant W. W. Hunter, who invented the Hunter submerged propeller, has also been called the "father of the steam navy." His propeller was used in the Union, Alleghany, Water Witch, and in the revenue cutter Spencer, none of which was successful. The machinery of these vessels was designed by Mr. William Ellis, engineer, at the Washington Navy Yard. The Alleghany was rebuilt as a screw steamer, and the Water Witch as a paddle wheel steamer.

Commodore Perry was a vigorous advocate of the paddle wheel; Lieutenant Hunter urged the Hunter submerged propeller (like a paddle wheel mounted on a vertical axis, working partly in and partly out of the sides of the vessel), while Commodore Robert F. Stockton earnestly urged the advantages of the screw propeller. Stockton first induced Ericsson to come to this country. They met with but little favor at the hands of the old Board of Navy Commissioners, and finally Stockton built the Princeton at his own expense, the machinery from the designs of Ericsson, and the hull by Lenthall. She was an eminent success.

Commodore Perry would serve in none but the paddle steamships, and disapproved of the Princeton *in toto*. Indeed, he once made a written report that paddle wheel steamers of the Collins line, with parts of machinery and boilers above water, "could have guns mounted on them, and would be first-class war ships." Perry had a great appreciation of the engineers. He "always had his ship chock full of them, generally nine to ten assistants; and when he went to Japan, about a dozen. Four would have been enough," said an old engineer in the navy. Commodore Perry would not allow any orders to be given to the engineer department of the ship except by himself. "Even when he was commodore, on board his flagship, he would himself give the orders concerning the machinery to the chief engineer." The chief engineer communicated directly with him. The commodore kept the firemen and coal heavers distinct from the ship's company. He called on the engineers for all sorts of things. Some were making drawings for him, some were employed on his reports, others collected information for him. When he visited shore in a foreign port, he sometimes took the chief and half a dozen assistant engineers with him, who examined things and made notes for him. His good treatment of his engineers was not precisely of the kind to excite their affection for him, for he seemed to think he owned them, as he did his steward and his secretary. In this spirit, he would not allow any one else to give them an order. His favorite ship was the Mississippi, perhaps because she was the largest after the destruction of the Missouri. Returning to the machinery of these two ships, it was probably the finest of its day. An able engineer recently said if it was to-day desired to build a paddle wheel engine of like power, with set condensers and the same pressure they used, it was doubtful if a single detail could be changed with any advantage whatever.

Mr. Copeland, while principal engineer of the navy, also planned the engines of the Saranac, Michigan, Susquehanna, the second engine of the San Jacinto, and the engines of the Niagara after he left the navy. The Saranac and San Jacinto were alike in hull, and were built to test the relative merits of the paddle wheel and the screw propeller. The San Jacinto's engine was designed by the engineer-in-chief, Mr. Haswell, and that of the Saranac, as we said above, by Mr. Copeland. With hulls and boilers alike, the test of type of propellers and engines was considered fair. Owing to a defect in the design the San Jacinto was greatly inferior as a steamship to the Saranac, though her machinery was quite under the water, while that of the latter named ship was quite exposed. The original engine was then removed from the San Jacinto and a new one, built by Merrick & Towne, of Philadelphia, from the specifications and designs of Mr. Copeland, was substituted. The San Jacinto then became quite the peer of the Saranac as a steamship, with the great advantage of having her machinery masked by the water. It appears then that the spirit of steam was first infused into the navy by Fulton; that though great credit is due the dead Perry, Stockton, and Hunter, yet history should write the names of the living Ericsson and the living Copeland in letters of gold among the fathers of the steam navy.—*Army and Navy Journal.*

Volapuk.

For some years past, and much more frequently of late, there have been references in English and Continental journals to the Volapuk, world's speech, or universal language, and it would seem as if in some quarters there is a growing inclination to take its pretensions seriously. A small volume recently published by Messrs. Whittaker & Co., containing the grammar and vocabularies of this invention in an English form, enables us to acquire some idea of the design and its merits. The originator is Mr. Johann Martin Schleyer, of Litzelstetten, Baden, Germany, and his work, which was first introduced to the world in 1880, has been translated into English by Mr. W. A. Seret, of Glasgow, who describes himself as "certificated teacher of the universal language." This gentleman tells us that Volapuk "has already gained a firm footing in Germany, Switzerland, Holland, Hungary, Italy, France, Sweden, and especially in Austria, and in Syria and Arabia, having been introduced also into Russia, South America, Asia, and the north of Africa."

We have no means of knowing what is to be understood by the "firm footing" alluded to, but it is certainly something far removed from everything approaching general adoption. But, as we said, it has evidently approached the stage when people begin to ask about it; the English Philological Society has discussed it with something like approval; one of those fierce Englishmen who perpetually write to the *Times* from Continental hotels has felt called upon to denounce it, and the leading journal itself has devoted a column of somewhat heavy banter to it. A defender of the language has since written from Paris, declaring that there are already some half million people corresponding in or still learning Volapuk, and announcing that a congress of Volapukists is to be held in Paris in 1889.

Mr. Schleyer's object seems to have been to provide a scientific, systematic, and easily acquired language, not to supplant others, but to furnish all nations with a ready means of communication, suitable especially for commercial correspondence by letter and telegram. No one who studies his scheme can help admiring the ingenuity of many of its parts and the scrupulous rigidity with which a rule once laid down is maintained. It seems cruel to have to add even one extra straw to the vast education which it appears is necessary nowadays for a commercial clerk who wishes to hold his own against the dreaded German; but a knowledge of Volapuk is a much more fearsome thing in sound than in reality. A few hours' study will enable any one with some philological knowledge to master its fundamental rules; and with a dictionary he could then translate either into or from Volapuk without much further difficulty.

Volapuk is based upon English, as the language most widely spoken; but it must be admitted that the reduction of English to rigid regulations has a compromising effect on such poetic beauty as it may have contained before. For instance, "man" is adopted for "man," "son" for "son," and "blod" for "brother;" but the Volapuk rule for making the feminine is to prefix the masculine noun with "ji" (pronounced *she*); we have, therefore, *ji-man* for woman, *ji-son* for daughter, and *ji-blod* for sister. To give another example of how words are built up in this artificial language according to definite rules, we may quote the word *gud*, which is the substantive form representing goodness. The adjective is formed by adding *ik* to the substantive, and the adverb by adding *o* to the adjective. *Gudik*, therefore, means good; *gudiko*, well; *gudikum* is better; *gudikun*, best; *gudon*, to make good; *gudikumon*, to make better, to improve; *gudikunon*, to make best, or as good as possible. The verbs are subject to great inflections, and can be made to express a great deal by prefixes and suffixes. Thus, *lof* is the root of the verb to love; *aiilofon* means a loving that will have been constant; *lofofsok*, those women love themselves. *Lem* is a bargain or purchase; *lemon* is to buy; *lemob*, I buy; *lemobs*, we buy; *alemobs*, we bought; *elemobs*, we have bought; *eilemobs*, we have bought constantly. *Sel* is a sale; *selon* is to sell; *selob*, I sell; *selobs*, we sell; *selol*, thou sellest; *selols*, you sell; *poselols*, you will sell; *liposelols*, will you sell?

We give these examples to show something of the system of building up words, and also to indicate how, possibly, Volapuk may prove of value for foreign telegrams. It is probable, at all events, that some commercial firms will think it worthy of further investigation.

The probability of English becoming the world's language is growing more rapidly year by year. It is estimated that when Shakespeare wrote, his language was spoken and understood by only about 5,000,000. The best judges now calculate that at least 100,000,000 talk and understand it, and vast populations in India, China, Japan, and elsewhere are acquiring it for business and social purposes. The race of which it is a native tongue is growing faster than any other in the world; and with the printing and circulation of literature, the danger has departed of the language becoming broken up into various dialects, as Latin was a thousand or fifteen hundred years ago. But it is possible that even among ourselves, as well as in communication with the great countries where English is not understood, something like this scientific language may serve a useful purpose. In that view we have thought well to offer these remarks concerning it.—*Chemist and Druggist.*

[SCIENCE.]

The Reis Telephone.

Some who have experimented with the Reis telephone declare that they have never been able to hear a transmitted word. Others have heard some words and sentences; but these have always been weak and irregular, so as generally to discourage one in a short time, especially now, when through the improvements in telephones it is possible to reproduce words both loudly and regularly. Experimenters, therefore, have been impatient with Reis' apparatus, and seldom have done anything with it, except make some hasty tests for some phase of the great telephone controversy.

The inefficiency of the Reis telephone has, by a kind of common consent, been admitted to be altogether due to the imperfect mechanical operation of the transmitter, by which the making and breaking of the current when it is in operation is such as not to properly follow the actual vibratory movements of the diaphragm when the latter is moved by speech vibrations; that at best it can deliver to the line only the fundamental rate of the vibration, leaving out the characteristic overtones which are supposed to be necessary to the successful transmission of speech. This judgment as to the mode of operation of the transmitter has been derived wholly from what has been heard by one listening at the receiver; for there is to-day no known method by which it may be determined whether or not a transmitter has the proper motions, except by listening at the receiver. That is the test. Hence it has been concluded that if speech was not properly delivered in a receiver, the trouble must be with the lack of proper movements of the transmitter. Yet it is mechanically possible for the transmitter to move properly, and the receiver to be so much overloaded, so to speak, that the latter fails to be heard on account of the extra disturbance.

The Page effect—the magnetic click—may be so strong in a Reis receiver, with a proper current, as to be heard a good many feet distant from it. When the receiver is held against the ear, the sound may be very loud; so much so as to quite drown weaker sounds, if they happen to be present. Especially when these loud sounds occur fifty or one hundred or more times per second, the effect is that of a continuous sound; and as the persistence of hearing is something like the tenth of a second, it follows, *a priori*, that such rates of vibration as from two hundred to a thousand per second might be present, yet too weak to be heard in the presence of such overpowering sounds that have an appreciable persistent effect. These loud magnetic clicks are heard only when there is a sudden break in the current in the receiver. If, then, some way can be devised for preventing these extraneous sounds in the receiver without interfering at all with the transmitter or its "mode of operation," one may experimentally determine whether the Reis transmitter does or does not act mechanically so as to vary the current in correspondence with speech or other sound vibrations. I therefore conceived that, if there was a short shunt circuit between the terminals of the transmitter, some of the current would traverse the coil of the receiver the whole time, no matter whether the circuit through the transmitter was open or closed. The loud clicks would be suppressed without interfering in any way with the "mode of operation" of the transmitter; and, if the latter really did follow the motions of the diaphragm, the variations in the current strength would correspond, and the speech would be heard. This I found to be truly the case: for with a transmitter thus provided with a shunt circuit of about two ohms, which could be switched in or out with a key, it was at once possible to hear a large part of what was spoken when the shunt was in. When it was out of circuit, the sounds were generally inarticulate.

This experiment is an *experimentum crucis*, and proves that the inefficiency of the Reis telephone is much more due to the extraneous sounds in the receiver than to the lack of appropriate motions of the platinum terminals of the transmitter. It proves that the transmitter does and must always have worked in the proper mechanical way, and that the current theory of its mode of operation is not correct. It proves, too, that when carbon is substituted for the platinum terminals, there is an improvement in efficiency, but not in its mode of operation.

A. E. DOLBEAR.

College Hill, Mass., Jan. 14.

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The Western Union Telegraph Office, New York.

When a person goes into the basement of the Western Union Telegraph building, and desires to inform his wife at San Francisco, 3,000 miles away, that New York is a wonderful place, and deposits a dollar bill for that purpose, he little imagines the extent to which his dollar supports his averment. He little imagines what the dollar does before the message reaches the first telegraph pole out from the building on its way across the continent. None of man's conquests is more amazing than his conquest of the lightning, and none of the strange things he does with it has reached such proportions as his employment of it in the capacity of an errand boy. While this has been growing commonplace, it has all the while been growing more and more amazing, and in the central office of this king of corporations, the Western Union, the process of telegraphy has reached a development such as can be seen nowhere else in the world. The dollar that pays for the transmission of an idea from Hell Gate to the Golden Gate does many interesting things.

It goes in at the receiving window and gets registered, together with the message it represents. Then it proceeds down stairs into the cellar, where it turns the wheels of fifteen mighty engines. One of these, applied to a huge dynamo magnet, draws from it the flame of 600 incandescent lamps, and sends it gleaming through the building. Three others engage actively in the work of enlightening the world. They supply the electric current that courses up and down the continent faster than light itself. They take it from fifteen little dynamo magnets, scarcely thicker than a man's thigh, arranged in rows or "gangs" of five each, and placed in a room scarcely larger than a hall bedroom. If two entire floors of the building were filled with Leyden jars, there would be, may be, 40,000 of them. But the power to be got from them all would be less than that derived from these little dynamos. Four other engines, the largest and most powerful of all, force currents of air through the most extensive underground pneumatic systems in the world. Tubes run from the building up to the branch office in Twenty-third Street, to other branch offices, and to all the principal newspaper offices. If the tubes were large enough to accommodate a man, he could be sent bowling along two miles underground in just ninety seconds with as much ease as if he were a feather.

It is up in the top of the building, however, that the novel sights are to be found. Seated in front of 700 little desks, each supplied with two or more noisy machines that clatter incessantly from year's end to year's end, is an army of young men and girls, the brightest, quickest, cleverest operators to be secured. Everything and everybody appear to be in a grand rush. Little boys and girls tear about as if thrones depended on their being at a given point in the room at the hundredth part of a given second. The continuous musketry of the sharp, rattling machines ever and anon grows heavier and fiercer as gusts break forth on a stormy April day. The very atmosphere seems excited and in a hurry, and well it may, for the air in the room is changed every three minutes. Four huge ventilating fans, driven by a special dynamo engine, carry off 2,000 cubic feet of air every second, and keep the atmosphere in perpetual commotion. A picture of a scene so confusing is difficult to paint. If anything would only stand still long enough to let the mental camera catch its image, there might be hope of obtaining at least a typical impression. But the room puts on as many new phases as the crowd that passes a Broadway corner. Placed well in its center is a little pagoda, an up-raised stand that might make a summer house were it set in a flower garden and overrun with vines. Here a group of little girls sit behind a circular table. Over their heads is gathered in a disk a hundred wires that run hither and thither all over the room, carrying little messenger cars, such as they have in the big stores running to the cashier's desk. Here there are so many of them, and they skim along in so many different directions, darting hither and thither, as if blessed with a head of their own and a perfect comprehension of their own business, which nobody can tell them better than they know it themselves, that one looks upon their intricate mechanism with amazement, and wonders why they don't come together in a general collision. If it be remarkable that they understand themselves, it is more remarkable still that these little girls, who have scarcely entered their teens, should know whence they all come, what they all carry, and where they all go. But with equal deftness and celerity, the children capture them all as they come, take out their cargoes of papers, affix to these a proper stamp, and send them whirling off again, all in the twinkling of an eye. When the messages have been received down on the basement floor, they are sucked through pneumatic tubes up into the operating room, and there seized upon by the little girls in the grand stand. Quick as a flash the addresses are read, and then they are whirled to that part of the room in which the particular operators are seated who work the particular lines over which the message is to go.

It takes nearly a thousand operators to accomplish a day's business in the Western Union. Some of this work is in the day time and some at night, and others do nothing except relieve the regular staff, while, in relays of fifty or seventy-five, they go up-stairs for luncheon. Thus there is no pause in the eternal rattle of the machines. The problem of perpetual motion is solved in that room as much as it ever can be solved. The messages that come into the office are treated pretty much in the same way as those that go out. The operators who receive them write them out on blanks and send them whizzing off in a jiffy to the little girls in the grand stand. When they are stamped for identification, they are dropped down through a sliding tube to the basement floor. A mirror at the bottom enables one to see directly through six stories and catch glimpses of the pig-tails and curly bangs up in the lofty grand stand. As the messages drop they are taken out, slid through steam rollers that copy them and drop them on a revolving endless belt, that takes them off to the routing clerks and the messengers. System is always simple, even in its most complicated forms. That is what system means. And yet the number of things that are done to a message in order to insure its rapid and accurate reception and delivery can but excite wonder.

Of course there are a great many secrets passing through that operating room—secrets that speculators in Wall Street would consider it well worth their while to know. Many a fact that has come over the wires from Chicago, addressed to some prince of the realm of speculation at twelve o'clock, if known an hour later to any important stock broker, would be held by him in high commercial esteem. This fact has not escaped the observation of operators who keep a business eye open, nor is the Western Union Co. blind to it. Arrangements have occasionally been made, in times of public excitement, between operators and men of speculative tendencies, for the quick transfer of messages designed to have important effects on public affairs. There are many occasions when the certain knowledge of an event—a presidential proclamation, a government concession to or demand upon one of the subsidized railroads, or of any such thing affecting the values of securities—should it come to the ears of a speculator even half an hour before it was made public, would enable him to make a fortune. The secrets of the wires are the richest kind of secrets, and the greatest care is taken to keep them inviolable. This is one of several reasons why the operators are not permitted to take their lunches outside of the building. A restaurant is fitted up for them on the topmost floor, provided with an extensive bill of fare, which is scheduled, according to the company, at cost prices. A sharp espionage is kept upon the movements of all employes. At the door of the big room stands an old, white-haired sentinel, whose forty years of telegraphic experience in all parts of the country has made him familiar with every one in the business. If a visitor calls, he either knows him at once or knows that he is not a fellow craftsman. At all times of unusual public excitement, when Wall Street is in a fever, extraordinary vigilance is exercised over all persons who call on the operators. They are always compelled to send in cards. These are taken first to the manager or his assistants. The person called upon is notified, and if he desires to see the visitor, he goes out into the hall. The opportunities for long or private conversation here are meager. A constant succession of chief operators and other authoritative persons is passing by at momentary intervals. If secrets are being divulged, the chances are that some part of them will be overheard, or suspicion aroused by some other circumstance. In that event the visitor is followed. It is not often that important secrets have contrived to get over this wall of scrutiny and care.

To the uninitiated it is a great puzzle how the dangers of lightning are averted where there are so many conductors of electricity as in a telegraph office. More than 2,000 different wires come into the Western Union building, and run more or less directly to the desks of the operators. Even when these electric attractions are wanting, most people confess to a certain feeling of insecurity when the elements rage and wake up terrifying flashes of forked fury. Nearly half the operators are young women, and they may be expected to share the general sentiments of their sex concerning this uncertain and wicked-looking force. But science has provided an answer to this, as well as to almost all other puzzles which stand in the way of human progress. Every wire, as it enters the building, passes through the bottom of a long narrow board, and then again through it at the top. This board is a lightning arrester. If the current is heavy, its first effect is to deprive it of much of its force. Should even this fail to deprive the current of its fatal power, and it passes on to the top of the board, it touches a spring which drops instantly and shuts off all connection with the operating room. This spring is called the plush magnet, and beyond it no overcharge of lightning, whether proceeding from a storm or from contact with other wires, can possibly go. Absolute security from outside electrical influences is thus insured. The wires proceed directly from the street to the switchboard in the operating room, where they are stopped. The wires attached to the machines in the room all run to this board, and connections are established there with the through lines.

There are 20,000 cities and villages in the United States to which the Western Union runs its wires, and naturally the task of making rates between each of these places and all the others is a grave problem. Four hundred millions of rates must be made, and every agent must know them all. When the company was confined to the space between Buffalo and Chicago, the process of arranging a tariff was comparatively simple. But when a boundless continent became its domain, the subject was no longer insignificant. The present method is so plain that the wayfaring man, though a fool, has no excuse for erring therein. The whole country is blocked out on a map in squares of fifty miles each, and the rate is fixed between each and all of these squares, and printed in a book that is newly revised and issued every six months. The public is greatly indebted to the competition of the smaller companies which from time to time have sprung up as rivals within certain territories to the Western Union for many additional simplifications of this system.

In the East there is but one tariff rate, and between adjoining States a similar arrangement usually exists. These smaller companies have been nearly all swallowed up in the Western Union, but their usefulness to the public in compelling reductions is not slight. The average business done in the main office of this giant monopoly is about 1,400 messages. As many as 2,800 have been sent out in a single day, and as 180 other offices are open in this city, these figures tell only a small part of the story. But they serve well to show the immense development of an art and a trade that sprang into existence within the memory of men still young, and which, were they suddenly lost to human knowledge and craft, would leave the world in strange and dismal darkness.—*New York Tribune.*

The Milling Machine.

At the recent meeting of the Society of Mechanical Engineers, a paper was read by John J. Grant, and entitled, "The Milling Machine as a Substitute for the Planer in Machine Construction."

The author called attention to the importance of using the milling machine, and that manufacturers were coming to recognize this fact, due largely to the diminished cost of using it, as compared with that in the use of a planer. He asserted that every part of a locomotive now finished by a planer could be better done by a milling machine, and at a half to one-tenth the cost, and producing work nearer to interchangeability. In order to settle the question in his mind, he made the following experiment. One hundred pieces of cast iron 16 in. long, large enough to finish 1½ in. by 1 in., used for lathe racks, were given to the man in charge of the milling machine, and an equal number of the same pieces to the man in charge of the planers. The cutter used on the milling machine was simply a plain spiral cutter of 2¼ in. diameter by 2 in. in length, costing to make in the shop, including stock, labor, and shop expenses, $2.10. This cutter was sharpened but once, and that after the completion of the job, which consisted in roughing the four sides of the 100 pieces. Two milling machines were used, one for roughing and one for finishing cuts. The cutters required grinding at the end of the job, and so were chargeable to it; the time required to grind them was 22 minutes. The wages of the boy running the machine were 9 cents per hour. The total cost for finishing the 100 pieces on the milling machine was, including shop expenses, estimated at 35 per cent of labor, $5.09.

The cost of the same number of pieces finished on the planer was as follows:

24 hours 35 minutes each machine, at 25 cents per hour..	$6.03
Grinding and setting tool 19 times, 1 hour 21 minutes....	0.33
Shop expenses, 35 per cent.....	2.22
Total.....	$8.58
Balance in favor of milling machine.....	3.09

In the above test, the author claims that the planer was acting at its best and the milling machine at its worst. The latter makes its best showing in irregular work, where the planer requires the constant attendance of skilled workmen, while the milling machine can employ a much cheaper grade of attendance.

He summed up the advantages as follows: Exact duplication of work; rapidity of production, the cutting being continuous; cost of production, as several machines can be operated by one workman, and he not a skilled mechanic; and cost of tools for producing a given amount of work.

Artificial Incubation in Egypt.

One of the oldest industries in Egypt is artificial egg hatching, principally engaged in by Copts. There are said to be 700 establishments of this nature in the country, and the production of chickens from the ovens is estimated at from 10,000,000 to 12,000,000 annually. The season for incubating lasts through three months of the early summer. The country people bring eggs to the proprietors of the "farroogs," and give two good eggs for every newly hatched chick.

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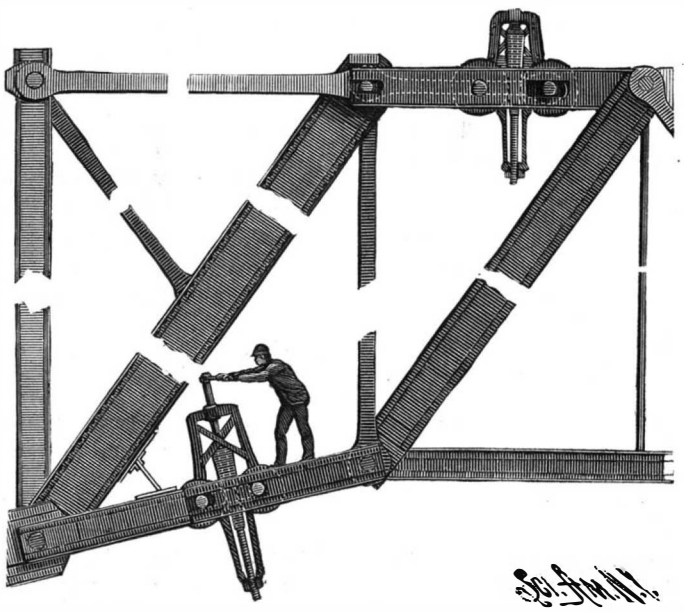
THE POUGHKEEPSIE BRIDGE.

This structure, now under process of erection by the Union Bridge Co., of this city, of importance both as a monument of engineering and as a link in the railroad system of the Eastern States, is rapidly approaching completion. About a year ago* we illustrated it, showing the proposed elevation and some general dimensions of the work. To-day much of what we then showed has been realized, and when the present year will be half over, it is hoped and believed that the bridge may be practically completed. The rapid progress is due to the system of construction. The cantilever has been utilized as far as possible. Pin fastenings have been used in the more important truss work, and small members have been employed. Almost all the riveting was done in the shops, and the eye bolts, struts, and chords were delivered on the ground ready to be put at once in place without delay. All this is in contrast to the system adopted for the Forth bridge between England and Scotland. There the bridge is built on the ground. For fastenings rivets are almost entirely depended on, and immensity of size characterizes as much the individual members as it does the whole structure. The two bridges illustrate well the difference between American and English practice.

Certain limitations were imposed upon the Poughkeepsie bridge that have affected its structure. Much opposition to its erection was offered by those interested in the navigation of the river. The great object to be attained was to obstruct the river as little as possible. To do this the four piers in the river were made very narrow. They were far too restricted in size to afford anchorage for cantilevers. A compromise structure consisting of a combination of anchorage trusses and cantilever spans was adopted. Starting from the shore at either end, a cantilever span is first encountered, next to this comes a truss span, followed by a central cantilever span. After this a second truss and a third cantilever span complete the structure as far as the river is concerned. A short cantilever at either end connects with the approaches. On the eastern side the approaches are very long, and are really an elevated railroad. The intermediate truss spans act by their weight and strength as anchorage spans for the cantilevers.



WEDGES BETWEEN CANTILEVER AND HANGING TRUSS.

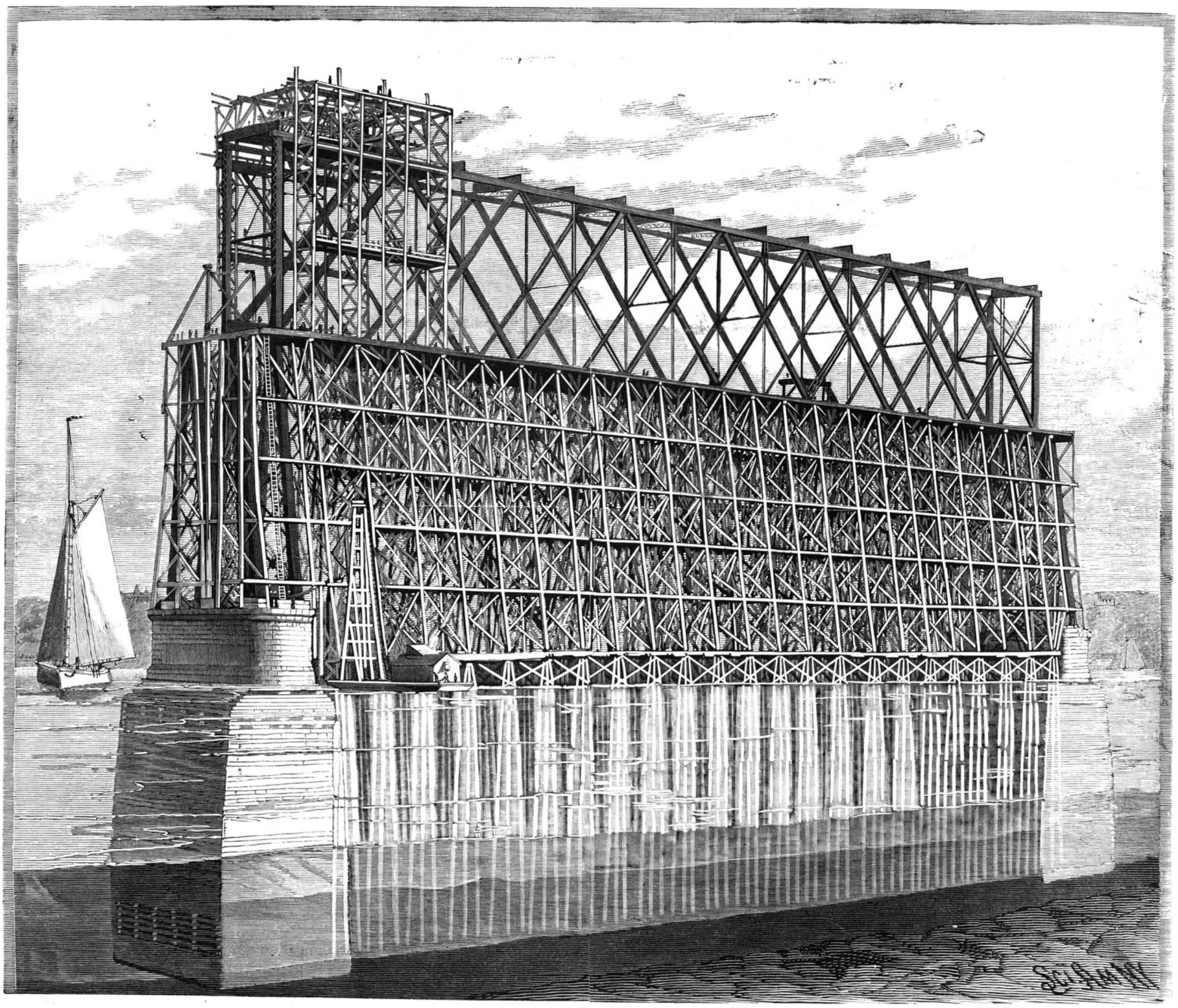
The river is crossed, therefore, in five spans, involving the placing of four piers in the channel. The clear opening of the spans varies from 500 ft. to 521 ft. 6 in., with 130 and 160 ft. head room.

These piers are twenty-five feet wide at water line. Thus it will be seen that little obstruction is offered to navigation. To provide against that little the bridge company is obliged by their charter to keep a tug-boat at hand for helping vessels through, and to place lights upon the piers. The latter consist of masonry bases that rise about 30 ft. above the water. Upon these the iron superstructure is erected, carrying the piers up 130 ft. Upon these the trusses rest.

A cantilever may be described as a gigantic bracket. To bridge an opening by them, two are carried out from either side projecting over the space below. When sufficiently close they stop, and the space between is closed by an ordinary truss suspended from their ends. But a bracket is without stability unless it is held in position. To provide this holding, the anchorage spans are made to alternate with the cantilever spans.

The piers being in place, the general method of erecting the bridge may be thus described. False work or centering of timber is first erected where the truss spans are to come. This in itself is no small work, as is evident from our illustration, taken from a photograph of the structure. The depth of the river and the stratum of soft mud necessitated extra long piling. The logs are spliced or fished to secure sufficient length to reach good bottom. These are well braced at their tops, and on them the trestle work is erected. Upon the false work the great anchorage trusses 525 feet long and 75 feet deep are set up. When one truss is completed, the false work is removed and stored away for future use, leaving one span completed, and standing isolated over the river. From one of its ends a cantilever is carried shoreward, while from the shore end a second cantilever is run out to meet it. The shore member is a double cantilever poised at its middle on its pier like a balance beam, and anchored down by great tie rods at the inner end.

Representing, as before said, two immense brackets, the pair of cantilevers are carried out over the intervening space without any false work. The strain exerted by each is a thrust backward at the foot and a pulling forward or tension at the top corner. These strains are sustained by the anchor truss or by reversed cantilevers. When the two have approached within 200 ft. of each other, work begins upon the connecting or hanging truss. Member by member this is put to-



ERECTING ANCHORAGE TRUSS ON FALSE WORK.

*See SCIENTIFIC AMERICAN, Vol. 56, No. 6.

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gether, and the work is carried out from the cantilevers as a base. The strains during erection, it will be clear, resolve themselves into one of tension for the upper chords and of compression for the lower chords of both truss and cantilevers. These are provided for by making the lower chord of heavy lattice and plate work adapted to resist a thrust until the central panels of the hanging truss are reached. The lower chord for these panels is composed of eye bars. The reason for this will be evident. So far the whole strain has been one of tension for the upper chord and of compression for the lower. The tension has come against wedges situated near the end of each cantilever. As soon as the members of the truss are in place, the wedge is backed out and the upper chord of the connecting truss is relieved from tension, and at once becomes a compression member, while at the same instant the lower chord of the truss ceases to be compressed and enters into tension. The only reason the lower chord is made of rigid character for the greater part of its length, enabling it to resist compression, is to make it capable of sustaining the strain of erecting. Its last chord members are put in as simple eye bars, because for the last panels the erecting strain is very light. As far as the actual bridge or truss functions are concerned, the whole chord might be of tie rods. The stiffness of the bottom chord takes the place of false work.

The wedge we have alluded to is in the upper chord. A second one is in the lower chord. The two are shown in the cut. Both are removed when the structure is joined. They are used during the last connecting to bring the parts together. By working them in or out, the projecting and meeting portions of the truss can be swung up or down and to right or left, so as to come into accurate alignment. When the last tie rods are in place and the wedges removed, the cantilever span can be distinguished as of three parts. By removal of the upper wedge the upper chord is "cut," by removal of the other the lower chord is "cut." Hence the through connection of both chords being destroyed, the truss exists as an independent structure. It is suspended at each end by a tie rod which is attached to the upper and outer corners of the cantilevers and to the lower corners of the truss. As the truss and cantilever expand or contract with change of temperature, the suspending rod swings back and forth, but no effect is produced upon the cantilever, as no thrust or pull in the absence of the wedges can be exerted upon it.

To carry on the work of construction, engine houses are mounted on wheels and travel out on rails as fast as the panels of the trusses and cantilevers are constructed. These contain hoisting machinery. The iron work is brought on scows, or on the shore underneath them, and the pieces are hoisted by steam power. As each piece comes into its place, the pins are driven in place. Where rivets are required temporary bolts are used, to be replaced by rivets in due time. Each foreman has a book giving explicit directions how to put the work together. The men, by practice, become apparently quite reckless in working at so great a height, but this is only apparent. They all wear arctics or rubber overshoes of some kind in winter, and rubber-soled shoes in summer, to be secure from danger of slipping. So far the casualties have been few.

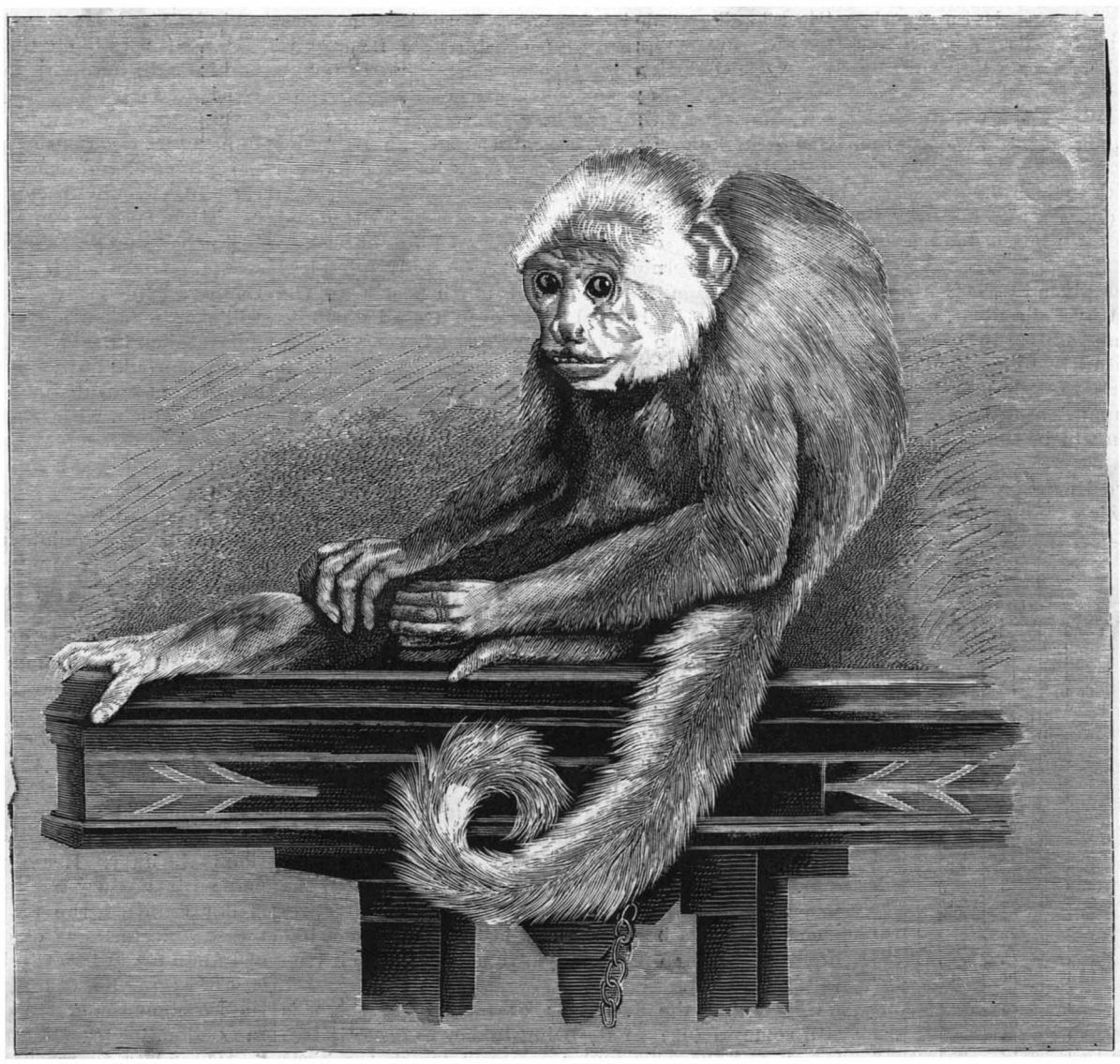
The bridge is made of steel, of about 63,000 pounds breaking strain. The members of largest section are the lower chords of the anchorage trusses. These represent a species of box girder in exterior dimensions, 30 inches deep and 40 inches wide. The largest member weighs less than 20 tons. The largest eye bars are 8 by 2 inches in section and 49 feet long. Others are 8 by 2¼ inches in section and 37 feet long. The largest eye bolts or pins are those receiving the thrust of the lower chord of the cantilevers. These are 9 inches in diameter. These dimensions may be contrasted with those of the Forth bridge, whose lower cantilever chord is a plate iron hollow cylinder 9 feet in diameter, and one of whose pieces is a cylindrical member 12 feet in diameter.

On each of the two piers nearest the shore, four sets of steel rollers, 3 inches by 3 feet 6 inches, and twenty-four in a set, carry the ends of the anchorage trusses and of the cantilevers of the east and west spans. These allow for expansion and contraction under changes of temperature.

Madder.

This coloring matter is more extensively used by cotton dyer and calico printer than by the wool dyer. It has been the subject of much research, and the composition and nature of its coloring principles are now well understood. It has long been used as a dyestuff. The ancient Egyptians, the Greeks, and the Romans are said to have used it. Though not a wood, it will be best to discuss it here in connection with the redwoods, as it holds, as a wool dye, a position intermediate between that of the redwoods and the yellowwoods. It is the root of a plant called *Rubia tinctorum.* Dr. Schunk states that the coloring matter exists in the plant as a glucoside, that is, in combination with a sugar. He calls the glucoside *rubian.*

The principal coloring matters yielded by madder are alizarine, purpurine, and pseudo-purpurine, of which the first is by far the most important, being the only madder color which may be considered fast and permanent. The artificial production of alizarine from anthracene, one of the products of the distillation of coal tar, is one of the most important and interesting applications of chemistry to the arts that has been made of late years. In 1868, Graebe and Liebermann found that when alizarine and zinc dust were distilled, the hydrocarbon anthracene was obtained, and by reversing the process they succeeded in obtaining alizarine from anthracene. The artificial coloring matter seems to possess all the properties of the alizarine of madder. In wool dyeing the chief uses of madder, besides acting as a ferment in the indigo vat, are for the production of drabs, browns, and olives, for which its coloring matters are well adapted. The colors obtained with madder on wool are very fast and permanent.—*Indus. Record.*



MATHEW, THE CUBAN MONKEY.

The Nose the Source of all our Woes.

At the last congress of German naturalists and physicians, held in Wiesbaden, Dr. Gacy reported several cases of mental disturbance characterized by an impossibility of fixing the attention on any subject, except for a very brief period, or of prolonged mental effort of any kind whatever. This condition, to which the author gave the name of aproxia, was always associated with certain lesions of the nasal mucous membrane and obstruction to the passage of air through the nasal fossæ.

This is, we believe, the latest accusation which has been brought against the sinful nose. Headache, cough, dyspnœa, earache, neuralgia, hay fever, acne, convulsions, and syncope are only a few of the many evils which this troublesome organ is accused of having inflicted upon long suffering man, and it bids fair to outstrip even the ovaries as a center for morbid reflexes. As regards aproxia, however, it is said not to be a reflex, and the mechanism of its production is assumed to be a purely physical one. The lymphatic spaces beneath the dura mater have been found to be in direct communication with the mucous membrane of the nasal fossæ, and inflammation of the latter is supposed to interfere with the elimination of the waste products resulting from cerebral activity, thus leading to mental sluggishness. But whatever may be its methods, the nasal organ is evidently responsible for many, if not most, of our ills. Clearly, the nose must go.—*Medical Record.*

MATHEW, THE CUBAN MONKEY.

We give an engraving, from *La Ilustracion Cubana,* of an educated monkey, brought up by Messrs. Lopez & Inelan, of Havana, where the animal enjoys a great reputation for intelligence. He will stand erect and salute all present, wrestle and fight with any dog of his size, compel a cat to be his most patient servant, capture a pigeon and make it open and shut its bill like a parrot, strike an attitude of the fiercest attack on signal from its master, or on a contrary signal relapse into the most submissive and inoffensive of creatures. The above is only the merest outline of a few of the many things which this remarkable animal has been taught to do. His fame having reached Madrid, he has been sent over there, where he now attracts great attention at the Retiro.

Kerosene Oil as an Anti-Incrustator for Steam Boilers.

Mr. Lewis F. Lyne read a paper before the last meeting of the American Society of Mechanical Engineers upon the use of kerosene oil for preventing incrustation in steam boilers. The experience upon which the paper was based was gained in connection with the working of the Jersey City Electric Light Company's station, where there are in operation two 100 horse power Root's boilers and one boiler of the same type developing 155 horse power. The water used in these boilers made a great deal of scale—so much, indeed, as to half fill with hard deposit the 4 inch tubes of which the boilers are principally constructed. Finding that no other expedient would rectify this evil, Mr. Lyne commenced to experiment with kerosene oil; allowing some of this kind of oil to flow into the boilers by means of an arrangement like a large steam cylinder tallow cup fixed upon the water feed pipe. When the experiment was started, there was about one-fourth inch of scale in the boiler tubes. Two quarts of kerosene were put into the boiler every alternate day for a month, when it was found that the scale was so far dissolved and loosened that a scraper would clear off most of it. Continuance of the treatment eventually cleared the boiler from scale in every part. Finally the rule was adopted of putting in one quart of kerosene oil per day for each 100 horse power boiler, and three pints per day for the 155 horse power boiler. The water is blown down two gauges every week, and the entire contents once a month. Water is never used to wash the boilers out, nor is a scraper necessary, for the mud all goes away with the water. Another thing worthy of notice is that, whereas it was impossible to keep gauge glass tubes in use more than a month or two, because they became badly corroded and grooved, and consequently broke, since kerosene has been regularly employed this corrosive action has ceased.

To keep frost, etc., off plate glass windows, keep the inside air dry, or inner sash tight, so that the air in window inclosure will be cold, and ventilated from the outside. A partial remedy is to have ventilating openings in the top of the window casing.

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Thermometer Scales.

Much annoyance is caused by the great difference of thermometer scales in use in the different civilized countries. The scale of Reaumur prevails in Germany. As is well known, he divides the space between the freezing and boiling points into 80°. France uses that of Celsius, who graduated his scale on the decimal system. The most peculiar scale of all, however, is that of Fahrenheit, a renowned German physicist, who, in 1714 or 1715, composed his scale, having ascertained that water can be cooled under the freezing point, without congealing. He therefore did not take the congealing point of water, which is uncertain, but composed a mixture of equal parts of snow and sal ammonia—about —14° R. This scale is preferable to both those of Reaumur and Celsius, or, as it is also called, Centigrade, because: 1. The regular temperatures of the moderate zone move within its two zeros, and can therefore be written without + or —. 2. The scale is divided so finely that it is not necessary to use fractions whenever careful observations are to be made. These advantages, although drawn into question by some, have been considered sufficiently weighty that both Great Britain and America have retained the scales, while the nations of the Continent, France, Spain, etc., use the other two.

The conversion of any one of these scales into another is very simple, and easily made. To change a temperature as given by Fahrenheit's scale into the same as given by the Centigrade scale, subtract 32° from Fahrenheit's degrees, and multiply the remainder by $\frac{5}{9}$. The product will be the temperature in Centigrade degrees.

To change from Fahrenheit's to Reaumur's scale, subtract 32° from Fahrenheit's degrees, and multiply the remainder by $\frac{4}{9}$. The product will be the temperature in Reaumur's degrees.

To change a temperature as given by the Centigrade scale into the same as given by Fahrenheit, multiply the Centigrade degrees by $\frac{9}{5}$ and add 32° to the product. The sum will be the temperature by Fahrenheit's scale.

To change from Reaumur's to Fahrenheit's scale, multiply the degrees on Reaumur's scale by $\frac{9}{4}$, and add 32° to the product. The sum will be the temperature by Fahrenheit's scale.

For those who wish to save themselves the trouble we have calculated the following comparative table:

C.	R.	F.	C.	R.	F.	C.	R.	F.
—30	—24,0	—22,0	14	11,2	57,2	58	46,4	136,4
—29	—23,2	—20,2	15	12,0	59,0	59	47,2	138,2
—28	—22,4	—18,4	16	12,8	60,8	60	48,0	140,0
—27	—21,6	—16,6	17	13,6	62,6	61	48,8	141.8
—26	—20,8	—14,8	18	14,4	64,4	62	49,6	143,6
—25	—20,0	—13,0	19	15,2	66,2	63	50,4	145.4
—24	—19,2	—11,2	20	16,0	68,0	64	51,2	147.2
—23	—18,4	—9,4	21	16,8	69,8	65	52,0	149.0
—22	—17,6	—7,6	22	17,6	71,6	66	52,8	150,8
—21	—16,8	—5,8	23	18,4	73,4	67	53,6	152,6
—20	—16,0	—4,0	24	19,2	75,2	68	54,4	154,4
—19	—15,2	—2,2	25	20,0	77,0	69	55,2	156,2
—18	—14,4	—0,4	26	20,8	78.8	70	56,0	158.0
—17	—13,6	1,4	27	21,6	80,6	71	56,8	159,8
—16	—12,8	3,2	28	22,4	82.4	72	57,6	161,6
—15	—12,0	5,0	29	23,2	84.2	73	58,4	163,4
—14	—11.2	6,8	30	24,0	86,0	74	59,2	165,2
—13	—10,4	8,6	31	24,8	87,8	75	60,0	167,0
—12	—9,6	10,4	32	25,6	89,6	76	60,8	168,8
—11	—8,8	12,2	33	26,4	91.4	77	61,6	170,6
—10	—8,0	14,0	34	27,2	93,2	78	62,4	172,4
—9	—7,2	15,8	35	28,0	95,0	79	63,2	174,2
—8	—6,4	17,6	36	28,8	96.8	80	64,0	176.0
—7	—5,6	19,4	37	29,6	98,6	81	64,8	177,8
—6	—4,8	21,2	38	30,4	100,4	82	65,6	179,6
—5	—4,0	23,0	39	31,2	102,2	83	66,4	181,4
—4	—3,2	24,8	40	32,0	104,0	84	67,2	183,2
—3	—2,4	26,6	41	32,8	105.8	85	68,0	185,0
—2	—1,6	28,4	42	33,6	107,6	86	68,8	186,8
—1	—0,8	30,2	43	34,4	109,4	87	69,6	188,6
0	0,0	32,0	44	35,2	111,2	88	70,4	190,4
1	0,8	33.8	45	36,0	113,0	89	71,2	192,2
2	1,6	35,6	46	36,8	114,8	90	72,0	194,0
3	2,4	37.4	47	37,6	116,6	91	72,8	195,8
4	3,2	39,2	48	38,4	118,4	92	73,6	197,6
5	4,0	41,0	49	39,2	120,2	93	74,4	199,4
6	4,8	42,8	50	40.0	122,0	94	75,2	201,2
7	5,6	44,6	51	40,8	123,8	95	76,0	203,0
8	6,4	46,4	52	41.6	125,6	96	76,8	204,8
9	7,2	48,2	53	42,4	127,4	97	77,6	206,6
10	8,0	50,0	54	43,2	129,2	98	78,4	208,4
11	8,8	51,8	55	44,0	131.0	99	79,2	210,2
12	9,6	53,6	56	44,8	132,8	100	80,0	212,0
13	10,4	55,4	57	45,6	134,6			

—*Industrial Record.*

Prehistoric Researches in Southeastern Spain.

Two Belgian engineers, Messrs. Siret, are about to publish the important results of their extensive archæological researches in Spain, which extend over the coast from Carthagena to Almeria. The oldest remains belong to the neolithic period. There is not a trace of metal to be found in these ancient habitations. The implements consist of polished axes, perforated shells, pottery, grinding stones, chipped flints, and primitive walls of stone. In another class of sites which belong to a more recent period, remains of copper and a few bronze implements were found. The inhabitants lived in stone houses, the stones being cemented by earth. Flint implements, particularly arrow heads and knives, ornamented pots, bone points, and numerous copper celts, were found in the houses. Cremation was practiced to a considerable extent by the people of that period. Copper ores and scoriæ proved that they practiced the art of smelting.

In a later period fortified villages, with walls made of stone and mud, were built on the tops of the hills. In the space surrounded by the walls, the ruins of burnt houses, implements, remains of grain which was kept in clay pots, cloth made of broom, and handmills were found. Flint was used only for making saws. The dead were buried in natural caves, or in stone boxes under the houses or near them.

At the end of the copper period the inhabitants still lived on the tops of steep hills, in fortresses. The implements consisted of the same material, but, besides, moulds for casting copper, ivory, gold, and silver were found. Over twelve hundred graves belonging to this period were opened. All of them were situated in the houses, and consisted either of small chambers of stone, of stone boxes, or of huge clay pots with rounded bottom and wide mouth. The largest of these are over three feet long and two feet wide. The skeletons are doubled up, hands and knees being pressed against the chin. Sometimes husband and wife are found in the same urn. The study of this vast amount of material will be highly interesting. Virchow points out that part of this ancient culture is probably due to Phenician influence.—*Zeitschr. fur Ethnologie*, 1887, No. v; *Science.*

Our Lost Species.

BY E. M. HASBROUCK.

Those species of North American birds termed "lost," and excluded from many of the lists in consequence, are at present of considerable interest to many ornithologists, both from the fact that a thorough search may, at any time, reveal the existence of some one, and that within the last few years two at least, the great auk (*Plautis impennis*) and the Labrador duck (*Camptolaimus labradorius*), are believed to have become absolutely extinct.

The first of these, *P. impennis*, has been written and rewritten upon so much of late, that I do not wish to say much concerning it here. "It formerly inhabited our coast from Massachusetts north nearly to the Arctic circle. In Iceland it has been traced down to 1844, while in the *American Naturalist*, vol. vi., page 368, is recorded the finding of a single dead specimen in the vicinity of St. Augustine, Labrador, in November, 1870." Unfortunately, the "character, date, and disposition of this alleged individual are questionable, and it seems improbable that the species lived down to so late a period." At present it is accounted extinct, but, with all due respect to the opinions of others, there seems to me to be still a chance for its being rediscovered, and, strange as it may appear, this chance I would place solely with the Arctic explorer. In the reports of different expeditions, we learn that after a certain latitude has been reached, the tide of migration changes its course, and that birds as well as mammals move in a northerly direction. This is pretty sure evidence that somewhere at the far north, beyond the region of snow and ice, there is a milder climate to be found, and one undoubtedly teeming with animal life. If, in the years to come, some one succeeds in reaching the pole, and discovers this land (if existing), does it not seem reasonable to suppose that the great auk will be found among its inhabitants? which, having experienced the persecutions of man, has sought safety and retirement within its borders. This last borders somewhat upon the Utopian, I know, yet time may prove it true in part at least.

Concerning the Labrador or pied duck, there is still some chance of its being taken, as recently two instances have come under notice in which the birds in question were picked and eaten by the shooter, and afterward, when too late, thought to have been specimens of this bird. In both cases the description tallies very closely with that of a cabinet skin. In a recent number of *Forest and Stream*, Dr. Shufeldt gives an able article on this subject, and strongly holds forth that the bird may still be found.

Leaving these so-called extinct birds, we come to the lost species proper, or those which, through scarcity or diminutiveness, have eluded the efforts of collectors since the original specimens were taken. Four of these have not been seen since the time of Audubon and Wilson, and are known only from their works. These are: The carbonated warbler (*Dendroica carbonata*), blue mountain warbler (*Dendroica montana*), small headed warbler (*Sylvania* (?) (*microcephala*), and Cuvier's kinglet (*Regulus cuvieri*). The others are scarcely of more recent date, and are: Townsend's bunting (*Spiza townsendii*), Brewster's linnet (*Acanthis brewsterii*), Bachman's warbler (*Helminthophila bachmani*), and the Cincinnati warbler (*Helminthophila cincinnatiensis*).

Eight species once known to science now lost!

Let us take them systematically, and try to discover the reason, and if possible the remedy, for such a state of affairs. In the first place, we must admit that all are small, and therefore less likely to be noticed than otherwise; and, secondly, that a number were taken in territory that has never been carefully worked, and in one or two localities little if any work has ever been done. *Carbonata montana* and *microcephala* were all taken in such region, namely, the mountains of Virginia and Kentucky, whose vast expanse certainly offers splendid fields for discoveries in this line; and when there in 1885, on the "Black Ridge" of the Cumberlands in Kentucky, I saw, among others, five of what I now and then firmly believed to have been *montana*, but owing to circumstances was unable to secure the birds. Concerning *R. cuvieri*, I can only say that the species is a supposed hybrid between *R. satrapa* and *R. calendula*, and unless exceedingly close could not be distinguished from one of these. Therefore, among the thousands upon thousands of kinglets that yearly pass the student, it is not improbable that specimens of this bird exist, and by collecting a large series one or more might be obtained and a long disputed point settled.

H. bachmani is a well tried and thoroughly established species, and up to within a few years was frequently taken. Several ornithologists have made trips through the localities in which it was formerly known to exist—South Carolina, Georgia, and Cuba—but nothing concerning it has of late been heard. It seems improbable that the species could have become extinct, and future explorations, perhaps in comparatively new country, may serve to bring it again to light.

Of *H. cincinnatiensis*, but one specimen has ever been taken, and that near Cincinnati, Ohio. It is presumably a hybrid between *H. pinus* (pine warbler) and *Geothlypis formosa* (Kentucky warbler). If such is the case it is unlikely that it will ever be taken again, and it ought hardly to have a place in this list, as it is considered more of an oddity than a species.

Brewster's linnet (*A. brewsterii*) and Townsend's bunting (*S. townsendii*) are each represented by a single specimen, and remain unique. No one knows to a certainty whether they are hybrids or representatives of distinct species. The one has not been taken since 1881; the other dates from as far back as 1833, when it was taken by Mr. J. K. Townsend, on May 11, in Chester County, Pennsylvania. It is doubtful whether either will ever be taken again, and if perchance it should, unless taken in sufficient numbers to guarantee its position, it would but confirm the opinion of its being the offspring of two distinct species. This, then, sums up the list, which, with the exception of three, still stand a chance of being rediscovered and placed on the permanent list of North American birds. There is always something peculiarly fascinating about searching for that which is liable to turn up at any moment, and until all disputed points in our ornithology are settled, students will continue to search for the desired information.

The Decadence of the China Tea Trade.

The Chamber of Commerce of Foochow, one of the three principal centers of the export tea trade of China, has responded to the appeal of the Chinese government, through Sir Robert Hart, to suggest remedies for the serious decline in the China tea trade. The substance of the letter in which this appeal was made was published in the *Times* of November 14. The Foochow Chamber points out that the vital consideration is the duty. Heavily taxed China tea cannot compete with the duty-free tea of India, and if the taxation is not remitted, the tea trade of China is within a measurable distance of extinction. The entire crop of Indian tea in 1890 will be laid down in London at a cost of 6d. per lb., or under, while the average cost of the Foochow Congou this year was 9d. per lb. laid down in London, for teas inferior to those of Indian growth. "It is too late to recover the ground lost, but timely and vigorous measures may possibly enable China to retain a good share in this important trade."

Other causes have contributed to the decadence of the China tea trade. Among these, the Foochow Chamber mentions negligent cultivation, imperfect firing, excessive admixture of dust and stalks, and fraudulent practices on the part of the native tea guilds. Formerly it was the practice among tea growers to trench the ground in the plantations, manure the plants, and prune them at least once a year, while every year some were replaced by new shrubs. Now, however, no trenching, manuring, or pruning is done, no new stock is planted, and the worn-out trees are so stripped that four and even five crops are taken instead of three, and the last crops are torn off with shears or bill hooks. "No wonder the teas show deterioration. No wonder the Indian leaf is preferred to such a product." Owing to want of sap in the leaf, the teas are so lightly fired that they commence to deteriorate within three or four months of packing. The dust and stalks have lost the Continental markets and those of Australia and Canada to the Foochow teas, and caused the latter to be replaced by tea from Ceylon.—*London Times.*

ONE of the best and simplest remedies for torpid liver or biliousness is a glass of hot water with the juice of half a lemon squeezed in it, but no sugar, night and morning. A person to whom this was recommended tried it, and found himself better almost immediately. His daily headaches, which medicine had failed to cure, left him; his appetite improved, and he gained several pounds within a few weeks. This is so simple a remedy that any person thus afflicted will do well to give it a trial, as it cannot possibly do any harm.

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PASCAL'S VASE.

T. O'CONOR SLOANE, PH.D.

The law of the pressure produced by a column of water is very perfectly illustrated by the apparatus known as Pascal's vase. In the illustration is shown a method of constructing it that is far better adapted to the purposes than the usual one. Several experiments or modifications of experiments can be carried out with it that the regular apparatus does not admit of. As shown, it is very simply made, and its construction will be within the capacity of any one of moderate mechanical ability.

For the vase, a wide-mouthed bottle is selected. This should have as true a neck as possible, as regards its lower face. The bottom is first cut off. This may be executed in various ways, the most reliable, perhaps, being the time-honored method —with a hot poker. The neck has now to be ground. Some sand is placed upon a glass plate resting on a table, and is well moistened with turpentine. The bottle is held on this neck downward and rubbed around for half an hour. Care must be taken to hold it steady, so as not to rock it. In this way a flat surface is produced, which may be smoothed off with ground pumice, used like the sand. The sharp edge, where the bottom was cut off, may be removed by similar grinding or by a few strokes of a file.

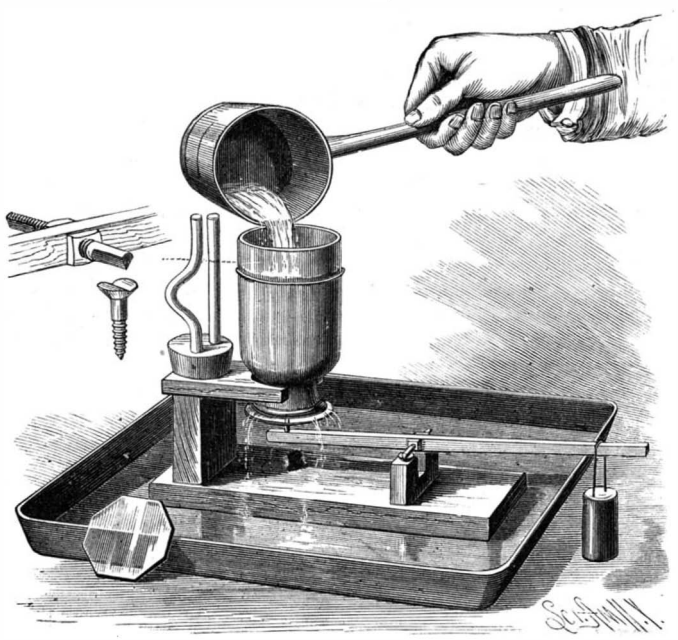
If the grinding is well done, the bottle, when placed with its open neck downward and resting upon a piece of glass, can be filled with water, which it will hold with scarcely any leakage.

A wooden frame is next made to hold the bottle. A semicircular opening grasps it tightly near the shoulder, holding it a couple of inches above the base. If it rocks or moves, a band of paper can be used as packing to secure it. To close its neck, a plate of perfectly flat glass is cut a little larger than the outside diameter of the neck. The plate may be square, octagon, or circular. The latter is the best shape.

A support for a balance beam is mortised or screwed fast to the base. A slot is cut in its axis, within which the balance beam can play. For fulcra, or bearings, for the knife edges, two wood screws are driven into the top on each side of the slot, and shallow open grooves are filed in them. The beam works upon knife edges, which are thus constructed. An iron bolt, about three-sixteenths inch diameter, is selected, one which has a long thread being best. Two nuts are required. One is screwed up as far as it will go. A hole is made through the balance beam, and the bolt is thrust through it until the nut comes against the beam. Then the other nut is screwed up so as to hold the beam in place. The projecting portions of the bolt are filed off to a straight and true knife edge, and the head of the bolt is cut off. If the threaded portion of the bolt should be too short to admit this treatment, one nut may be reamed out and passed beyond the thread upon the cylindrical portion of the bolt. There it must be secured by soldering. This forms a good abutment for the beam to bear against. Care should be taken to have the bolt perpendicular to the beam. The knife edges are quite hard enough for the limited work the balance is required for.

Upon the upper surface and near the end of the beam a notch is made. Into the other end at the upper surface an iron pin is driven as near as possible to the center of the opening of the neck of the bottle when the beam is in its bearings. This pin is filed to a sharp point. A couple of lead weights are arranged to hang from the notched end of the beam. These are easily cast in paper. A sheet of paper is rolled around the end of a round stick of wood, such as a broom handle, so as to project a couple of inches beyond the wood, and tied securely with string. The paper should be eight or ten layers in thickness. Into the cylindrical cavity thus formed the lead is poured when just melted, and while still fluid the suspending loops are placed in it, and held until all is solid. Two weights of different sizes should be provided.

The apparatus is arranged as shown in the cut. The weight holds the glass plate against the bottle, only the sharp point of the pin on the balance touching its under surface. Water is now poured into the vase. If the weight is not too heavy, as soon as a certain level is reached the water will begin to run out between the glass plate and the ground surface of the neck. The level of the water where this occurs is marked by springing an India rubber band around the bottle. This illustrates the downward pressure of water. The flask can never be filled any deeper. Any excess of water introduced escapes until that level is reached. The flask may now be emptied, and a cork fitted with two small tubes of any size and shape is inserted from above into the neck. Water is now poured into these. The object of having two tubes is to permit air to escape from the space between the cork and plate. A single tube, if of sufficient diameter, will answer. As soon as the marked level is reached, the plate is again forced off its seat and water escapes. The tubes can only be filled to the same level as the large vase. Finally, the tubes are removed, the flask is half filled, and a solid cylinder, such as an empty bottle, is immersed in the water so as to raise its level. Nothing happens until the mark is reached, when again the plate is forced off its seat and water escapes.



PASCAL'S VASE.

Thus the law is proved that the pressure exerted by a column of water on a given area varies with the height of the column of fluid producing it, and not with its volume or shape.

THE ELECTRICAL TYPE WRITER.

BY F. HIGGINS.

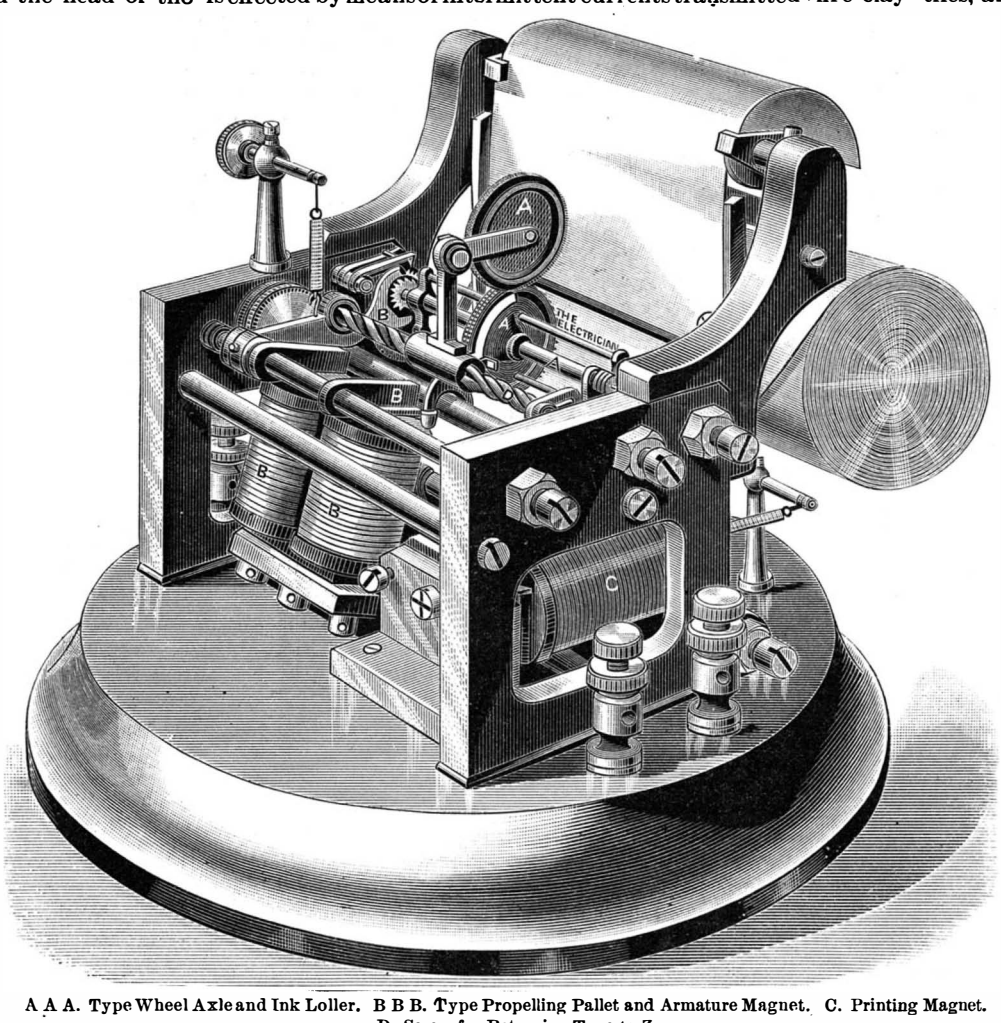
This apparatus, which fulfills the functions of a type writer at any distance from the keyboard, consists of a type wheel, which contains the letters of the alphabet, numerals, and stops. The rotation of the type wheel is effected by means of intermittent currents transmitted from a commutator under the control of a pianoforte keyboard acting on propelment pallets carried by the lever suspended over an electro-magnet. The number of currents transmitted determines the position of the type wheel with respect to the swinging frame, which serves as a guide to the paper, and at the same time as a platen to make the impression. This frame is pivoted at its end, and carries an armature, which is acted upon by an electro-magnet.

The type wheel is automatically traversed horizontally after the printing of each letter, in order to take up a position for the succeeding character until the end of the line is reached, when the operator restores the type wheel to the starting position by pressing the appropriate key. At the time this takes place the paper is advanced sufficiently to space between the lines, and the operator may by making successive contacts rapidly advance the paper as much as may be required, either to commence a fresh subject or to eject sufficient paper to bring the end of the message well into view.

The lateral spacing of the characters is uniform, and is determined by the printing operation. The platen frame, in falling back, rotates a screw which carries the type wheel and ink roller. The spacing between the lines and the return of the type wheel to the starting point are effected at the same time by pressing a key which corresponds to a position on the commutator and the type wheel which is not occupied by a letter. A pin projecting from the type axis at this point causes the intervention of a block which acts as a fulcrum to a lever connected to and worked by the platen, but which only comes into operation to release the type wheel when thus provided with a fulcrum, and consequently only when the act of printing takes place with the type wheel in this position. A spring returns the type wheel to zero.

Synchronizing between the receiving and transmitting apparatus is secured by means of a lever, which is geared to a type axis by friction, and is carried by the revolution of the latter into the path of a projecting pin. Upon a print being made, this lever is reset at its starting point, but should three revolutions of the type wheel be made without a print, the wheel will be arrested at zero. By commencing a message always upon the zero or spacing key of the transmitter, the apparatus will be in unison.

Ink is supplied from an inking wheel in the usual manner.—*The Electrician.*



A A A. Type Wheel Axle and Ink Loller. B B B. Type Propelling Pallet and Armature Magnet. C. Printing Magnet. D. Screw for Returning Type to Zero.

THE ELECTRICAL TYPE WRITER

Making Pig Iron with Gas.

The *American Manufacturer* says that Mr. Jacob T. Wainright, a well known metallurgical engineer of Pittsburg, Pa., has succeeded in making pig iron with natural gas as fuel. His furnace differs from the ordinary blast furnace in this, that, while dispensing with coke, it has overcome the great difficulty noted in connection with other experiments in gas furnaces by a mechanical device for supporting the burden. This device consists of a series of pipes covered with fire clay tiles, and at the same time ventilating the pipes with a current of air. A combustion chamber is also connected with the furnace, which reduces the amount of gas needed to produce the required heat, and also prevents the chilling of the furnace, which has been a great obstacle to the success of other experiments.

In the new furnace the ordinary cupola blower is used, and the gas and air are introduced in a very simple manner into the combustion chamber in a separate pipe. The current for cooling the tubes, already mentioned, is supplied from the same air blast, and from thence may be utilized in the furnace. Ordinary cupolas may be easily altered, so as to do the required work, by adding the combustion chamber and the protected tubes for supporting the burden.

The tests were made at the iron and lead works of William G. Price, on Price Street, where the inventor had the hearty co-operation of the manager, Mr. David Carlin. Mr. Carlin says that the furnace worked rapidly, and that its success is no longer an experiment.

Transfer Paper.

Brackelsberg's multiplying paper consists of sheets of paper, each one supplied with a coloring layer, whose principal element is a violet aniline methyl. An oiled leaf serves as a hard, smooth under layer. Place a sheet of the copy paper on this, then a sheet of writing paper, and write with a hard lead pencil. The back of the writing paper will give a negative of the writing in high color. Wet the copy sheet thoroughly, and from it twenty or more copies can be made, which will not roll nor show a gelatinous coating. Embroidery and compass-sawing patterns are finely rendered in this way.

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ENGINEERING INVENTION.

A grip for tram cars has been patented by Mr. Daniel T. Denton, of Tower Mines, Minn. Combined with a hook secured on the bottom of the car is a staple adapted to enage the hook, a slide carrying the staple and being secured to the cable, making a device by which a car may be attached to or detached from a wire rope without stopping.

MISCELLANEOUS INVENTIONS.

A car brake has been patented by Mr. David D. Chidester, of Hackettstown, N. J. The device has a brake with a shoe connected to a main body, combined with an interposed spring or springs, to prevent the "setting" and sliding of the wheels, and the consequent flattening of their treads.

A compressor has been patented by Mr. Harry H. Jones, of Lancaster, N. H. It is especially adapted for compressing dry or nearly dry powdered substances into solid form, particularly in the making of what are known as compressed tablets, in combination with a novel mechanism for automatic measuring.

A walking toy has been patented by Mr. George T. Fallis, of St. Joseph, Mo. It is a mainly inclosed pendulum and rocker construction, to simulate human beings or animals, whereby, when placed upon an inclined plane, it will by its own gravity automatically step out and walk down the plane.

An adjustable cuff retainer has been patented by Mr. Robert L. Pratt, of Tigerville, La. It is a device wherein a cuff fastener and wristband fastener are adjustable with respect to a sleeve fastener, whereby the sleeve wristband is adjusted coincidently with the cuff, so that it will not project beyond the cuff.

A wrench has been patented by Mr. Vandiver J. Van Horn, of Goff's, Kansas. It is so made that a pipe may be readily gripped and turned thereby when lying upon the floor or close to a wall, giving a large amount of leverage with a small device, which will hold firmly without slipping any sized pipe or nut within its capacity.

A harness pad has been patented by Mr. Somers Van Gilder, of Knoxville, Tenn. It is formed with side flanges, in combination with strips stitched to the outer surface of such flanges, with an ornament secured to the strips between their outer edges and the edges of the skirt, whereby the harness may be very highly ornamented at comparatively small cost.

A cuff holder has been patented by Mr. William J. Walters, of Prospect, N. Y. It has three integral parts, a head, shank, and tie, the latter adapted for attachment to a piece of elastic carrying at one end any approved form of spring snap for attachment to a shirt, the whole device being simply and cheaply constructed and of neat appearance.

A bolt has been patented by Mr. John E. Parker, of Hamilton, Ontario, Canada. It is designed more particularly for doors hinged to swing in both directions, the outer end of the bolt which engages with the apertured plate being formed with two or more bevels, and with a stop for holding the bolt in the aperture of the plate.

A shutter worker has been patented by Mr. James K. McGukin, of Newark, N. J. This invention covers a novel construction and combination of parts, affording means whereby a shutter may be opened or closed, and locked in either position, with the lower window sash down, the device being simple, cheap, and effective.

A child's carriage has been patented by Mr. Eugene A. Gerbracht, of New York City. This invention covers a novel construction and combination of parts, making a carriage of simple and cheap design, which can be readily transformed from a carriage to a cradle, or *vice versa*, and in which the body is peculiarly hung to give a fine spring effect.

A car pushing device has been patented by Mr. Richard Lukins, of Randolph, Neb. The base has depending guides on opposite sides of the rail, and the connection of the pinch bar with a handle lever is in the rear of the pivoted connection of the lever with a swinging fulcrum, making a device of very simple construction calculated to develop great power.

A coal scoop has been patented by Mr. Frederick B. Barrows, of Duluth, Minn. It is made with two body parts pivotally connected to a supporting frame by bars or pins fitted to the walls of the scoop sections, and passed through tubes fixed to the supporting frame, with other novel features, being designed for automatically loading, carrying, and discharging coal, grain, or other substances.

A method of and device for fitting garments has been patented by Mr. Edward Stahl, of Prescott, Arizona Ter. It consists in applying pattern material to a bust band, forming a downfold in the material, and applying the band and material to the bust just beneath the arms, then cutting the downfold to fit over the shoulder, and cutting the material below the band to fit the waist.

A tamping tool has been patented by Messrs. Warren B. Waldron and George C. Boller, of Folsom City, Cal. It consists of a head formed with a tapering dovetailed groove, and a handle with a tapering projection on its lower end, fitting in the groove of the head, making a tool which may be used without unnecessary stooping on the part of the operator, and in which the head, as it becomes worn, may be renewed.

A saw mill feed device has been patented by Mr. W. Hampton Gibbes, Jr., of Columbia, S. C. Friction disks of unequal size are fitted to slide on the carriage feed shaft, with a lever for moving them, in combination with friction disks mounted on another shaft, the two sets of disks being arranged to engage each other to effect the reciprocations of the carriage and control their speed at will.

A tricycle has been patented by Mr. George W. Rodecap, of Middletown, Ind. This invention covers a novel construction and combination of parts in a machine in which the power is applied to the wheels through treadles in an easy manner and with great regularity, while the tricycle may be steered in any direction, and the pivot wheel quickly turned at any angle with relation to the frame.

A laryngoscope has been patented by Mr. Josef Leiter, of Vienna, Austria-Hungary. It has an electric lamp within a cylindrical casing, and a reflector for throwing the rays into the cavity to be examined and in line with the eye of the operator, with other novel features, making an improved surgical instrument for viewing interior parts of human and animal bodies.

A dental matrix has been patented by Mr. John H. Reed, of Lancaster, Wis. It consists of a hard metal yoke, with a screw, and a band of softer metal, to be attached to the yoke by tongues passing through apertures in the yoke, making a device for supporting the filling while being inserted in a cavity in a tooth, supplying the place of one or more of the natural walls of the tooth cavity.

A dental plugger has been patented by Mr. Benijah S. Byrnes, of Memphis, Tenn. The casing contains a spring whose tension may be increased or diminished to vary the force of the blows struck by the hammer, while the plugger may be thrown out of and into gear without stopping the revolution of the spindle, and the device is not liable to injure the teeth or unduly hurt the patient.

An electric conduit has been patented by Messrs. Robert Van Buren and James J. Powers, of Brooklyn, N. Y. It is formed of sections of non-conducting material, perforated longitudinally for receiving the electrical conductors and provided with recesses or sockets at one end, being tubulated at the opposite end, so that the sockets of one section will receive the projecting portions of the opposite section, making continuous conduits or channels for electrical conductors.

A slate grinding or dressing machine has been patented by Mr. Samuel S. Marshall, of Slatington, Pa. It is for grinding school and other slates, and has a wheel with flat grinding surface and passages for sand and water, there being beneath the wheel hollow standards supporting vertically adjustable tables upon which plates carrying the slates are reciprocated, the pressure of the grinding wheel being increased or diminished as desired.

A wire tightener has been patented by Mr. John W. Wear, of Walker, Mo. It has tongs with jaws having guides for the wire, with interlocking portions adjacent to the guides, to sustain the lateral strain, a drum or wheel being journaled in the tongs and a wire connected with the drum or wheel, with other novel features, making a device especially adapted for taking up the slack of telephone and telegraph wires, tightening fence wires, etc. The same inventor has a further patented invention in which a straining lever is pivoted to the tongs, the lever being connected with the wire to be strained by a rod or chain with a hook, and the lever being so arranged that more or less strain can be exerted, as desired.

NEW BOOKS AND PUBLICATIONS.

UNDER THE SOUTHERN CROSS. By Maturin M. Ballou. Boston: Ticknor & Co. 1888. Pp. xi, 405.

This very elegantly printed volume describes the author's travels through Australia, Tasmania, New Zealand, Samoa, and other Pacific islands. Most of the ground covered by the work may seem old material, but the constant development and increasing civilization of the regions in question gives a value to all recent descriptions and makes possible a thoroughly new and fresh book of travels. Mr. Ballou's graceful and graphic style imparts much vivacity to his tale. His description of the present status of the uncivilizable aborigines of Australia is of special interest in the light of the march of events, which sooner or later will sweep the interesting natives off the great continent. The book may be unhesitatingly commended to our readers.

MANUAL OF PHARMACY AND PHARMACEUTICAL CHEMISTRY. By Charles F. Heebner, Ph.G. New York: Published by the author. 1887. Pp. 213. Price, $2; interleaved, $2.25

The object of this work is to supply the student of pharmacy with a manual adapted for his special work. At the same time, the author by his research and judicious selection of material has made much more than a student's manual. The book possesses a character of permanent value as a reference book for the practicing pharmacist. It treats of the chemical examination of all leading articles of the pharmacopœia, the tests for purity, etc. The various processes of pharmacy, percolation, filtration, and the like, are first described quite exhaustively. Then inorganic and organic pharmacy are successively treated, giving the examination of the many compounds dispensed by the pharmacist. In many cases the preparation on the large scale of the products is given, and reactions are used wherever required. The book may be had either interleaved for the owner's special notes or plain. It forms an attractive, clearly arranged, and useful little volume.

A MANUAL OF PRACTICAL HYGIENE. By Edmund A. Parkes, M.D., F.R.S. Edited by F. S. B. Francois de Chaumont, M.D., F.R.S. Seventh edition. Philadelphia: P. Blakiston, Son & Co. 1887. Pp. xx, 766.

It is quite impossible to review this comprehensive and admirably arranged work within the limits of our space. It covers the subject of hygiene in all its bearings and relations. The conditions of soil affecting health and modes of examining and preparing the site for encampments are first treated. The question of water supply comes next. This includes the quality of water, its preservation, tests for impurities, filtration and other methods of purification, the search after water, etc. Next comes one of the most difficult problems in camp and city hygiene—the removal of excreta. The different methods of securing adequate sewerage by water and the dry methods are fully described. Air and its impurities, warming, ventilation, food and diet, beverages and condiments are all treated of at length, under their headings. Exercise, clothing, and the hygiene of the individual are topics for other chapters. Under climate, the various conditions of the air, its humidity, composition, including ozone and malaria, are treated. Meteorology and the use of meteorological instruments, disinfection and deodorization statistics, and the prevention of some common diseases fill the last four chapters of Book I. The second book is of a more special character and is devoted to the soldier, as recruit in foreign service on board ship, and in war. This is largely written from the English standpoint, the localities of foreign service embracing the leading fields of English operations. The third book, devoted to chemical and microscopical investigations of water, air, and food products in general, is of special interest and value. The book contains numerous illustrations and a number of very interesting plates in microscopy. A reasonably full index, the table of contents, and the generally clear and classified arrangement of the book add to its value and make the work of reference easy.

SCIENTIFIC AMERICAN BUILDING EDITION.

FEBRUARY NUMBER.

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1. Elegant Plate in Colors showing the perspective elevations of two Dwellings at Orange, N. J., costing about Five Thousand Dollars each, with floor plans, sheet of details, etc.
2. Plate in Colors of a House in the Colonial style, costing about Five Thousand Five Hundred Dollars, with floor plans, sheet of details, etc.
3. Elevation and first story plan of a Splendid Apartment House.—Geo. H. Griebel, architect, New York.
4. Perspective view and floor plans for a Suburban Residence, costing Sixteen Thousand Dollars.
5. Illustrations consisting of plans and perspective, for a corner house to cost about Five Thousand Five Hundred Dollars.
6. Views of two substantial Dwellings, at Springfield, Mass.
7. Perspective view and floor plans of a Dwelling of moderate cost.
8. Illustrations of a Residence at Latrobe, Pa., and a residence at Pittsburg, Pa., with floor plan.
9. Engraving of the beautiful new Cancer Hospital, New York.—C. C. Haight, architect.
10. Front elevation and plan of a small School House, costing about One Thousand Eight Hundred Dollars.
11. Perspective sketch of Main Stairway and Hall of the Handsome Residence of Mr. D. J. Chandler, at Chattanooga, Tenn.
12. Illustrations with floor plans of Snow Hall of Natural History, at Lawrence, Kansas.—Mr. J. G. Haskell, Topeka, Kas., architect.
13. Engravings of the Tavern, the Casino, and Casa Grande, at Decatur, Ala., also a picture of the Anniston Inn, at Anniston, Ala.
14. Sketch of the Birthplace of James Watt, at Greenock-on-the-Clyde.
15. A Riverside Residence at Maidenhead.—E. H. Bourchier, architect.
16. Suggestions as to the adornment of Highways, with five figures.
17. Two perspective views and floor plans of a Villa on the Square of the Bois de Boulogne, in Paris.
18. Pictures of the great Lumber Raft recently lost at sea.
19. Designs for Furniture.
20. Scene in the Court of Inquiry as to the Cause of the Fire at the Opera Comique, Paris.
21. Miscellaneous Contents: Plastering; how it is applied, finished, and decorated.—Brick as a Building Material.—The Doorway of San Petronio at Bologna.—How I Build an Ice House.—Fireproof Wood.—Flow of Water through Pipes.—Classification of Styles.—Recent Discoveries at Pompeii.—Pressure at which Lead Pipes Burst.—New Materials and Inventions.—French Plaster.—New Method of Waterproofing Brick Walls.—Building Prospects.—Importance of Carpentry.—Permeability of Building Materials.—Compost for Cuttings.—Stiffness in Girders.—The Temple of Soleb, Ethiopia.—The Architect of Rome.—Worthless "Fireproof" Buildings.—Compound for Patching Stone.—The Chair of Queen Hatasu, illustrated.—The E. N. Gates System of Hot Water Heating, illustrated.—How to Braze Brass to Copper.—An Agate Forest in Arizona.—Pratt's Blind Opener, illustrated.—Drawing Instruments.—The Cortright System of Metal Plate Roofing, with illustrations.—Adjustable Tools, illustrated.—Art Metal Work, with illustration.

The Scientific American Architects and Builders Edition is issued monthly. $2.50 a year. Single copies, 25 cents. Forty large quarto pages; equal to about two hundred ordinary book pages; forming, practically, a large and splendid MAGAZINE OF ARCHITECTURE, richly adorned with elegant plates in colors and with fine engravings, illustrating the most interesting examples of Modern Architectural Construction and allied subjects.

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Wanted—Latest and most approved machinery for making bone buttons. A. K. Gardiner, 4 Cedar St., N. Y.

The *sole* builders of "The Improved Greene Engine" are the Providence, R. I., Steam Engine Co.

For House Pumping.—For sale cheap—A 5" Rider air engine, with 1½" pump. But little used. H. N. M., P. O. box 773, New York.

Manufacturers of ice and cold air machinery, send address to W. A. Stiles, 15 North Clinton St., Chicago, Ill.

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Send postal to A. J. Holmes, Saratoga Springs, N. Y., for information that will be of interest to all housekeepers.

Belting.—A lot of good second hand belting for sale cheap. Samuel Roberts, 369 Pearl St., New York.

Wanted—Manufacturers of ice machines to correspond with Geo. A. Noble, Anniston, Ala.

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$50,000 worth of farms, etc., for good business or building material. W. J. Paul, Omaha.

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The *Railroad Gazette*, handsomely illustrated, published weekly, at 73 Broadway, New York. Specimen copies free. Send for catalogue of railroad books.

The Knowles Steam Pump Works, 113 Federal St., Boston, and 93 Liberty St., New York, have just issued a new catalogue, in which are many new and improved forms of Pumping Machinery of the single and duplex, steam and power type. This catalogue will be mailed free of charge on application.

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Supplement Catalogue.—Persons in pursuit of information of any special engineering, mechanical, or scientific subject, can have catalogue of contents of the SCIENTIFIC AMERICAN SUPPLEMENT sent to them free. The SUPPLEMENT contains lengthy articles embracing the whole range of engineering, mechanics, and physical science. Address Munn & Co., Publishers, New York.

The Holly Manufacturing Co., of Lockport, N. Y., will send their pamphlet, describing water works machinery, and containing reports of tests, on application.

No. 11 planer and matcher. All kinds of woodworking machinery. C. B. Rogers & Co., Norwich, Conn.

New Portable & Stationary Centering Chucks for rapid centering. Price list free. Cushman Chuck Co., Hartford, Conn.

Steam Hammers, Improved Hydraulic Jacks, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

60,000 *Emerson's* 1887 ☞ Book of superior saws, with Supplement, sent free to all Sawyers and Lumbermen. Address Emerson, Smith & Co., Limited, Beaver Falls, Pa., U. S. A.

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Lathes for cutting irregular forms a specialty. See ad. p. 62.

Practical Working Drawings of machinery made by A. K. Mansfield & Co., 280 Broadway, N. Y. Lifelong mechanics. One formerly R. R. supt. M. P. Important references. Work guaranteed. Correspondence invited.

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Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(1) J. S. asks by what means street venders of microscopes give the appearance of animal life existing in a drop of water. We have tried many drops of stagnant water, but are unable to discover the existence of animal life to extent shown by them on the street. A. The vender has a little sour paste at hand, of which he manages to get a particle in the drop of water he places in the field. See explanation in SCIENTIFIC AMERICAN of March 13, 1886.

(2) W. H. B. asks: 1. Is there any remedy that I can use to wash the eyes that will strengthen them and not injure them? A. Use a little salt in water for bathing them once or twice a day. 2. A description of a simple water motor that I can make to run a lathe? A. See SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 180 and 270, for simple water motors.

(3) C. W. asks if photographer's tin type is too thick for the diaphragm of a phonograph. What other substance could be used in the place of tin type? A. Tin type plate, or very thin tin, answers very well. Mica has been used for this purpose, with good results.

(4) Bell asks: How many Law cells do I need to ring a small resistance electric bell 400 feet distant? How do you work out such problems? Is there any other open circuit cell preferable to the sal ammoniac? What is the ordinary resistance of the common 2½ inch bell? A. Two or three would be sufficient. There is no way of working out such problems, as the constants vary with every bell; the sal ammoniac battery is the most popular for open circuit, although the Lalande-Chaperon potash battery is excellent; there is no standard resistance for such bells.

(5) N. J. G. asks how to make one or two batteries (to put in the same circuit with two Leclanche batteries) to ring a large electric bell three or four times a day. A. The battery described in SCIENTIFIC AMERICAN, vol. 57, No. 25, if charged with a solution of sal ammoniac, may be used in circuit with Leclanche batteries. The latter are, however, the best.

(6) J. L. S. asks if there is anything that can be applied to an old scar (in the face) that will take out the blue color. A. Under certain circumstances blisters made with croton oil have produced satisfactory results, but all such experiments should be made under the guidance of a physician who is a specialist in skin diseases.

(7) C. L. H. asks: How to make a liquid cement for putting bill heads, letter heads, etc., in tablet form, that can be applied cold with a brush, and also, how to color it red, blue, or green. A. The article generally used consists of a cheap glue with 5 per cent of glycerine made with a suitable composition with some coloring material like Prussian blue, carmine, or any other dry pigment.

(8) M. F. B. asks: 1. Does the presence of copper tubes in steam boilers cause electrical action to take place in the same? A. They are liable to. 2. If so, is that the reason they are not more used? A. The difference of expansion and contraction between copper and iron, with their additional cost, is the principal cause of their little use.

(9) B. P. asks how to test sugars and to detect if they contain any glucose. A. Dissolve the sugar in water, filter through charcoal if colored, then add Fehling's solution, and a red precipitate indicates glucose.

(10) F. A. F. writes: I have a valuable book near which a lamp upset and spilled part of it with oil—common kerosene. How can I remove the oil, without destroying paper or removing the ink? A. Much of the oil can be removed by cautiously heating the book, causing the evaporation of the more volatile constituents. Kerosene can be removed by passing a brush dipped in essential oil of turpentine, heated, over the paper while still hot. When it is removed, dip another brush into ether, chloroform, or benzine, and apply over the stain, especially the edges.

(11) L. W. M. asks (1) how to make or mix the wax for electrotyping. A. Put some common beeswax into an earthenware pot, and place it over a slow fire; and when it is all melted stir into it a little black lead or white lead, about 1 oz. to the pound of wax. This mixture tends to prevent the mould from cracking in the cooling, and from floating in the solution. The mixture should be remelted two or three times before using it for the first time. 2. The remedy for concaving of the mould? A. It will not concave if made thick enough. 3. What is "Star Moulding Composition," which is something besides beeswax? A. It may be the composition recommended in answer 1, or it may be beeswax alone, or a mixture of beeswax with resin.

(12) H. P. writes: I have a spirit varnish made of juniper gum, 80 gr.; mastic, 100 gr.; elemi, 30 gr.; concentrated essence of turpentine, 60 c. c.; castor oil, 25 c. c.; alcohol, 1 liter. I can color it red with dragon's blood, yellow with gamboge. What transparent brown stain can I use in connection with the above? (It is for violin varnish.) A. Procure any aniline color from the druggist, of desired shade, and dissolve it in the alcohol, incorporating it directly with the other ingredients.

(13) A. Z. asks: 1. Can you give me the formula for making quinine and rum hair tonic? A. The quinine tonic has the following composition: glycerin, 4 oz.; alcohol, 3 oz.; water, 10 oz.; tinct. cantharides, 2 drachms; sulphate of quinine, 25 grms.; oil of roses, 2 drops; neroli, 5 drops; tinct. cudbear sufficient, and sulphuric acid sufficient to dissolve the quinine. The other consists of bay rum, 2 pints; alcohol, 1 pint; castor oil, 1 oz.; carbonate of ammonia, ½ oz.; tinct. cantharides, 1 oz. Mix them well. 2. Is junior only used after a person's name when the father is living and bears the same name? A. When a man in business has become widely known as "Jr.," he sometimes retains the same form after his father's death.

(14) N. U. asks: What will remove "rust" from window glass. It is something that forms on the glass if stored in a damp place for a long time. A. Try a mixture of 30 parts of water with 7 of hydrochloric acid and a trace of iodine. Rub the plate with a linen rag moistened with the fluid and then polish.

(15) S. S. G. asks: Will there be any economy in fuel by using the exhaust from the engine for heating purposes where a number of coils of 1 in. pipe are used, and will the engine loose any power by so choking the exhaust? A. The use of exhaust steam is not only economical to the extent of its entire value as a heating element, but is coming into almost universal use in our factory practice. The later systems of distribution relieve the engine in some cases of *any* additional back pressure, and where long exhaust pipes are used can be made to relieve the engine from its normal back pressure. There are but very few places where more than from ¼ to ½ lb. of back pressure will be required to utilize the whole exhaust.

(16) C. J. M. asks: Is there any benefit derived from wetting bituminous coal before firing in an ordinary steam boiler furnace? A. None whatever, beyond the sticking of the dust and slack together, to prevent its falling through the grate, or the dust being drawn over the bridge wall in brick set boilers, or into the tubes of locomotive boilers, without being burned. All the water used in this way is so much heat wasted in converting it into steam to clog the tubes with vapors at too low a temperature for steam making.

(17) R. S. desires (1) a receipt for making a cheap, penetrating liniment? A. Alcohol, 1 quart; oils of origanum, 2 oz., and wormwood, 1 oz.; with camphor gum, 2 oz.; spirits of turpentine, 2 oz.; and tincture of cantharides, 1 oz. Mix. 2. A receipt for making a liquid glue. A. Fill a glass jar with broken up glue of first quality, then fill it up with acetic acid. Keep it in hot water for a few hours until the glue is all melted. 3. A receipt for making a cheap soap that will remove grease and paint. A. Take of aqua ammonia, 2 oz.; soft water, 1 quart; saltpeter, 1 teaspoonful; shaving soap in shavings, 1 oz. Mix together; dissolve the soap well, and it will be found to be an excellent grease eradicator.

(18) G. N. G. writes: In a 23 inch pinion driving wheel, with 24 teeth, with a 9 foot spur wheel, with 114 teeth, should the teeth be just the same size in both wheels to run nice, or should the teeth in the pinion wheel be a little smaller than those in the spur? The wheels are on a pair of hoisting engines. A. The pitch should be the same for both wheel and pinion, but the form of the teeth should vary with the relative variation in the size of the gears in respect to each other. See Nystrom's "Mechanics," which we can furnish for $3.

(19) J. S. asks: If I place a hollow vessel at the depth of 20 ft. deep in water and fill it with air, say it contained 50 gallons, what amount of foot pounds of power would it produce in its ascent to the surface? A. The lifting power will be equal to the weight of the water displaced, with a correction for the weight of the vessel. A gallon weighs about 8·33 lb., which multiplied by 50 is 416½ pounds. Multiplying this by the distance gives the amount of foot pounds, 8,330 lb., leaving out of consideration the weight of the vessel. This should be subtracted.

(20) J. H. asks the proper way to set a tuyere iron in a forge, to set mortar over the rim, or let the rim of tuyere iron stand out over the mortar. A. Fire brick should be cut to fit snugly around the edge of the tuyere flange, a little above its face (say ¼ to ½ inch). If possible, cut the brick so that it will catch under the flange, which will prevent the loosening of the brick in working the fire.

(21) J. O. asks (1) what can be put on windows to keep the frost from accumulating on them? A. Wiping the windows on the inside with glycerine is a partial preventive of frost. Ventilation from the top or double glass is the best. 2. Will a stationary engine make a greater number of revolutions per minute with a steam pressure at 120 lb. than with a pressure of 100 lb., if the ordinary pressure carried is 100 lb.? Will not the governor regulate this and not let the speed increase? A. The governor will regulate the speed of the engine with variations of work; but will not keep the regulated speed with increased steam pressure, without being itself regulated for the increased pressure.

(22) M. I. asks (1) how he can increase the power of the 8 light dynamo described in the SCIENTIFIC AMERICAN SUPPLEMENT, No. 600, so it will work 12 lights. Would it do to wind the field magnets of the dynamo described in SCIENTIFIC AMERICAN SUPPLEMENT, No. 161, with No. 18 double cotton covered wire? A. Do not depart from instructions given for dynamo described in SUPPLEMENT, No. 161. To increase the capacity of the eight light dynamo, double the width of the cores of the field magnet, double the length of the armature, using No. 19 wire on the armature, and same as in eight light on the field.

(23) S. asks in what form ammonia is used as a baking powder, and in what proportion with other powder. A. Mix ¼ pound tartaric acid, ½ pound alum, ¾ pound pure bicarbonate of soda, 1 pound flour, and 3 ounces carbonate of ammonia. A better and simpler form of baking powder is the following: 30 ounces cream tartar, 15 ounces bicarbonate of soda, and 5 ounces of flour. Alum is considered injurious.

(24) F. B. F. asks: 1. How many 2,000 candle power electric lamps can be furnished with a 30 light dynamo? A. If the dynamo is rated for 30 arc lamps, but a few more can be supplied from it. Possibly the rating is below its real power. 2. If a greater electric current is sent over the wires, is that not the same as a greater electric force or power? A. The work done by an electric current varies not only with current or intensity, but with its tension. A greater current at lower potential could be distributed by the same expenditure of energy. 3. Does not each lamp added to a circuit offer additional resistance to the electric current? A. Each lamp added to a circuit in series increases the resistance. Arc lamps are usually used thus. If added in parallel with other lamps it decreases the resistance of the circuit. But it possesses its own definite resistance and counter electromotive force. If added to a circuit in either series or parallel, it will require additional electrical energy for its action.

(25) C. E. G. asks: What method can be used to clean the leaves of old books? A. See the processes described in SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 115 and 124. 2. Can writing ink be removed from the pages, and if so, how? A. Some inks it is almost impossible to remove without also destroying the paper. You might try first washing the paper with warm water, using a camel's hair brush, then the paper must be wetted with a solution of oxalate of potash, or, better still, oxalic acid, in the proportion of one ounce to half a pint of water. Finally again wash the stained place with clean water, and dry it with blotting paper.

(26) A. M. H. asks the best way to remove burned oil from an engine, or other piece of cast or wrought iron. A. Use a strong solution of caustic soda and water. What this will not remove, take off with a scraper. Finish bright work with fine emery paper and kerosene oil.

(27) J. E. W. desires directions for aanlyzing ice; that is the formula necessary to detect impure parts in ice. A. Most of the impurities are soluble in water and hence can only be determined by an elaborate analysis. Of course solid impurities can be detected by filtration, and an excellent test is to evaporate a given quantity, and so determine the total solid. Bacterial examination is also used.

(28) A. L. C. desires a receipt for making Florida water. A. Take two drachms each of the oils of lavender, bergamot, and lemon; 1 drachm each of tincture of turmeric and oil of neroli; 30 drops oil of balul and 10 drops oil of rose; mix the above with 2 pints of deodorized alcohol.

(29) E. H. W. asks what cheap article to use to make sulphur tough. Must be something that will dissolve under heat. A. Add resin or shellac to the sulphur.

(30) J. K. F. asks: What will take the stain of iron rust out of white marble? A. Take ½ ounce butter of antimony, and 1 ounce oxalic acid, and dissolve them in 1 pint water, add flour, and bring the composition to a proper consistence. Then lay it evenly on the stained part with brush, after it has remained on few days, wash it off, and repeat the process if the stain is not quite removed.

(31) G. C. S. asks how to clean silk plush so the surface will be as smooth and straight as new. Cleaning it with a liquid (as far as I know) leaves it in about the condition a drowned rat is in, fur all matted down. A. Clean it with the usual solvent, for which see table given in SCIENTIFIC AMERICAN SUPPLEMENT, No. 158. Then, to restore the plush, hold the wrong side over steam arising from boiling water, until the pile rises; or dampen lightly the wrong side of the plush, and hold it over a pretty hot oven, not hot enough to scorch, however, or make a clean brick hot, place upon it a wet cloth, and hold the plush over it, and the steam will raise it.

(32) P. G. H. asks: 1. What should be the focal distance, and distance apart of a pair of 4 inch condensing lenses for a magic lantern? A. The 4 inch condensing lenses should be 7 inches focus each, and placed back to back, nearly touching. 2. What should be the focal distance and distance apart of a 2 inch objective of medium power (achromatic)? A. The 2 inch objective for a lantern should be 6 inches focus for each lens, plano convex; place 2 inches apart back to back. If each pair is achromatic, the details of curves should be known in order to advise.

(33) B. D. F. asks concerning the use of arsenic for the complexion, in what form is it used, and if Fowler's solution of arsenic is dangerous in long usage. If the usage of arsenic changes the colors of the blood, or has it effect on the skin? A. We do not approve the use of arsenic in any shape for the complexion, and would not indorse its employment except under the direction of a physician.

(34) E. L. H. asks: Kindly inform me what work gives internal resistances of various sized cells, etc. A. No such figures can be given, as every variation in the strength of solution makes the resistance vary. For bichromate batteries without porous cells, 12 square inches of zinc, to ½ ampere may be allowed. The following resistances are sometimes given:

Grove cell	½ ohm.
Daniell cell	3 to 5 "
Gravity cell	2 to 4 "
Smee cell	1 "
Leclanche cell	1 "

(35) R. L. McI. writes: I have ten Grenet batteries, each holding one pint of fluid. What candle power Edison lamp will they work, and for how long without recharging? A. A 3 or 4 candle lamp for one or two hours.

(36) W. W. B. asks: Is it a fact beyond question that plants emit oxygen by day and carbon dioxide by night? If so, can this reversal be accounted for? A. Plants under the actinic influence of sunlight emit oxygen by day. At night they emit carbon dioxide gas. It cannot be accounted for any more than their other vital processes.

(37) C. C. B. asks: Will you kindly answer through your valued paper how sulphur may be rendered plastic and melted? A. By heat; also by pouring into water while melted, and in the viscous state. See query 29.

(38) Subscriber asks: Is there, or has there ever been, in existence any clock or other mechanism in which, while the motive power is being run down or diminished it is being replenished or renewed as fast as it is lost, so that, granting that the mechanism never wore out, it would continue in motion forever, without any addition to the original power? A. No.

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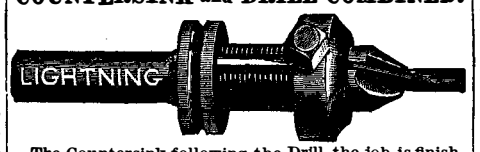

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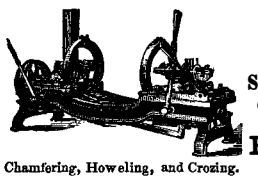

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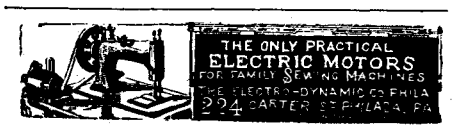

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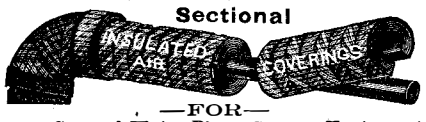

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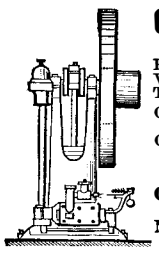

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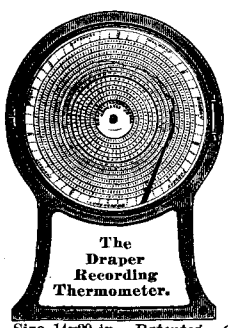

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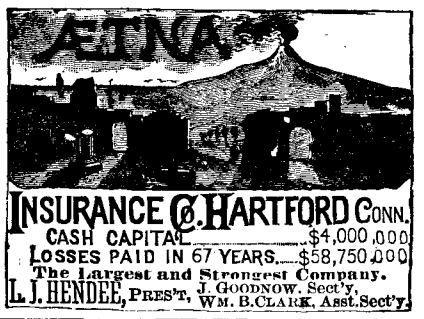

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Proposals for Tools for the Navy Yard, Portsmouth, Virginia.—NAVY DEPARTMENT, Washington, D. C., *January* 12, 1888.—Sealed proposals will be received at this Department until 12 o'clock noon, on Thursday, the 1st day of March, 1888, at which time and place they will be opened in the presence of attending bidders, for furnishing tools and materials required by the Bureau of Construction and Repair, and for the delivery of the same at the Navy Yard, Portsmouth, Virginia. Printed schedules particularly describing the tools, blank forms on which proposals must be made, and all other information essential to bidders can be obtained by regular dealers in, or manufacturers of, the articles required, on applicat on to the Commandant of said Navy Yard. Proposals must be made in duplicate, and enclosed in sealed envelopes marked "Proposals for Tools for the Navy Yard, Portsmouth, Virginia," and addressed to the Secretary of the Navy, Navy Department, Washington, D. C. All bids must be accompanied by either plans or descriptive cuts of the principal tools which the dealer offers to furnish. The Secretary of the Navy reserves the right to reject any or all bids, in whole or in part, as, in his judgment, the interests of the Government may require.
WILLIAM C. WHITNEY, *Secretary of the Navy.*

NAVY DEPARTMENT, WASHINGTON, *December* 30, 1887.—The time fixed by this Department's advertisement, dated November 2, 1887, for receiving proposals for 6-inch gun lathes, and slotter, is hereby extended to 12 o'clock noon, February 2, 1888, at which hour the opening of the bids will take place. WILLIAM C. WHITNEY, *Secretary of the Navy.*

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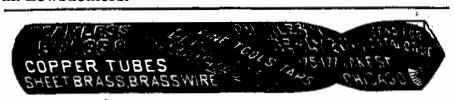

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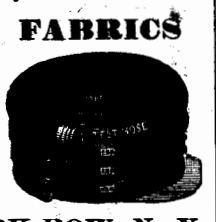

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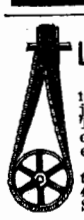

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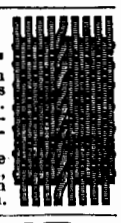

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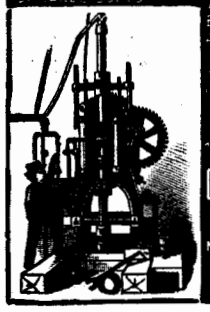

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